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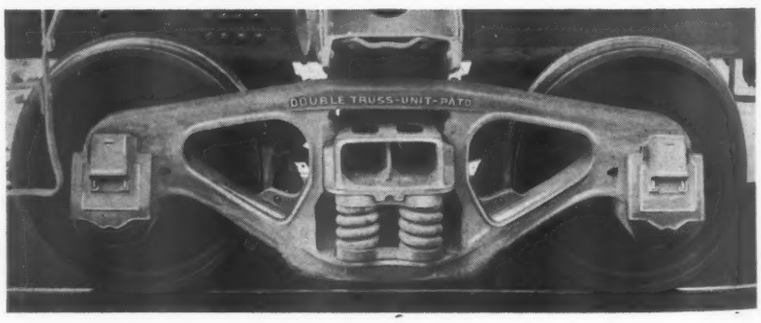

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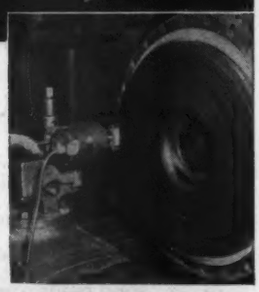

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THE EDITOR'S DESK

SPECTACULAR ACHIEVEMENTS — BUT ?

Many factors have combined to complicate and increase the present difficulties of the railroads. The rubber and oil situation has brought back to them a lot of business, both freight and passenger, that had been carried on the highways. The almost practical elimination of coastwise steamship traffic has made it necessary for the railroads to take on this additional load, much of which consists of long hauls. Instead of freight going by boat, from coast to coast, it has to be taken across the continent by rail. Instead of coal going from the Virginia mines direct to the waterfront and being dumped into ships by special facilities, to be distributed along the coast, it is now transported entirely by rail, in some instances over roundabout and inadequate routes.

The western railways have had to revolutionize their practices to accommodate the extremely heavy movement of freight and passengers to west coast ports—ports and facilities, by the way, that were never intended to handle so heavy a traffic.

These are only typical of some of the new and unusual demands that have been made upon the railroads. Summing up, the number of tons of freight hauled one mile in 1942 was almost double that in 1939, and almost half again as much as in 1918, the peak year in the first World War. Passenger traffic, measured by the number of passengers carried one mile in 1942, was two and one-third times what it was in 1939 and about one-quarter again as much as in 1918. Rail traffic is still growing. It is estimated that the increase in freight business in 1943 over 1942 will be about 10 per cent and that for passenger traffic about 25 per cent.

It would take a book to do justice to the ways and means by which this remarkable performance of the railways is being accomplished. Moreover, it is being done at a time when the railroads are not being shown any particular consideration by the selective service draft boards. They have also lost many capable executives and supervisors who were not subject to the selective service draft, but volunteered to help build up the Military Railway Service, some parts of which are already giving a splendid account of themselves in supporting our troops on various fronts.

There are now actually 25 per cent less freight cars than in 1918, and almost 30 per cent fewer passenger-train cars. There are about 34 per cent less locomotives, although measured in terms of tractive force, the deficiency is only about eight or nine per cent. With less equipment and much greater traffic than in 1918, the railroads are carrying on without congestion, but this is being accomplished only by almost superhuman efforts on the part of the men and management, and splendid co-operation from the shipping and traveling public.

The danger is that because they have staged such a spectacular performance the authorities may fail to realize the fact that they are reaching the top limit of capacity. They must carry on!

Roy V. Wright

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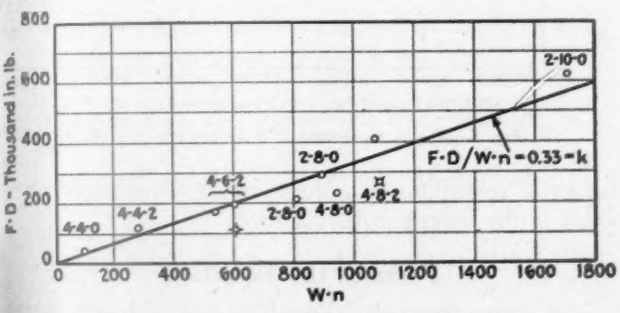
Locomotive Machine Friction

By Lawford H. Fry*

A general expression is derived from a study of experimental data from over 375 individual test-plant runs

THE purpose of this article is to obtain a general expression for the machine friction of a steam locomotive. The experimental data is taken from locomotive testing-plant reports for the eleven locomotives listed in Table 1. The data is from tests made on the plants at Purdue, at the University of Illinois and at the Altoona plant of the Pennsylvania. A wide variety of designs and sizes are covered, ranging from Goss's 4-4-0 type locomotive



F × D = friction torque = friction drawbar pull × driving-wheel diameter
W × n = effective weight on drivers = weight on drivers × number of group coupled axles

Fig. 1—Relation between friction torque and effective weight on drivers

with 61,000 lb. on drivers to the Pennsylvania Class IIs, 2-10-0 type with 342,000 lb. on drivers. Friction values for over 375 individual test runs have been plotted.

From this mass of experimental data it is concluded that the machine friction is related to the number of coupled axles, the total weight on drivers and the driving-wheel diameter by the equation

$$F = \frac{0.33\ n \cdot W}{D} \qquad (1)$$

Where

n = the number of driving axles coupled in a group
W = the weight on all driving wheels in pounds
D = the driving-wheel diameter in inches
F = the machine friction in pounds of drawbar pull

This equation indicates that with four driving axles carrying a given adhesive weight the machine friction with all drivers coupled will be twice that which will be found if the axles are coupled in two pairs. In the first case, n, the number of group-coupled axles is four, in the latter case, two.

In the case of each locomotive studied comparison of the computed with the measured friction shows no greater deviation than is found among the measured values themselves.

The experimental data is plotted in Figs. 1 to 11. In Figs. 2 through 11, the observed friction drawbar pull is plotted against the total measured drawbar pull. Each point is marked to indicate the speed at which the test was run. In a series of tests at one speed it is evident that an increase in drawbar pull must correspond to an increase in cut-off. The plots therefore serve to show

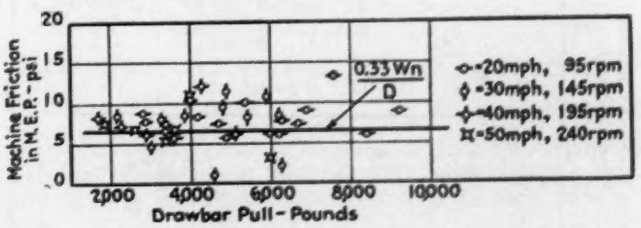


Fig. 2—Purdue 4-4-0, No. 2—Superheated

the effect, if any, that speed and cut-off have on the value of the machine friction. Through each plot a horizontal line is drawn corresponding to the value of the machine friction derived from the application of equation (1).

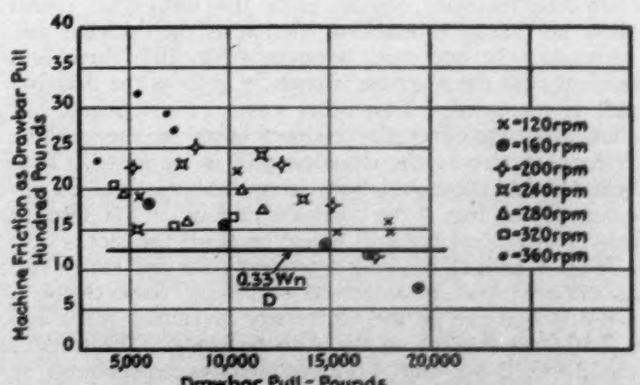


Fig. 3—Pennsylvania 4-4-2, Class E6s No. 51—Bulletin No. 27

* Railway engineer, Edgewater Steel Company, Pittsburgh, Pa.

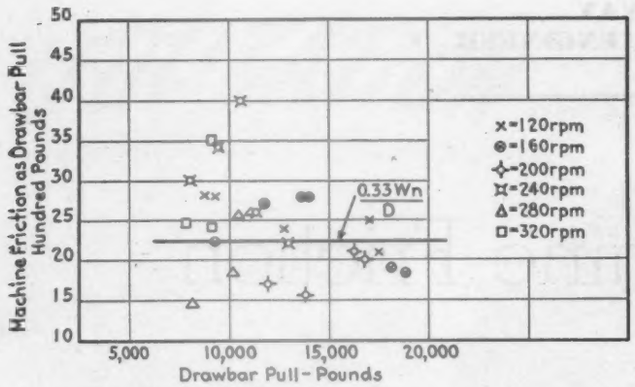


Fig. 4—Pennsylvania 4-6-2, Class K2s No. 877—Bulletin No. 18

From these ten plots it is concluded that:

1—Precise measurement of the machine friction of a locomotive is difficult. In every plot the individually measured points deviate from their mean value by at least 50 per cent of that value.

2—There is no indication that the machine friction is affected by the speed.

3—In the majority of the test groups there is no systematic change in machine friction as the drawbar pull is changed by changing the cut-off. That is to say, in the majority of the plots the points for the individual tests group themselves about a horizontal line.

4—In the majority of cases the lines drawn from equation (1) represent the individual tests reasonably well.

Careful consideration of all evidence available has led

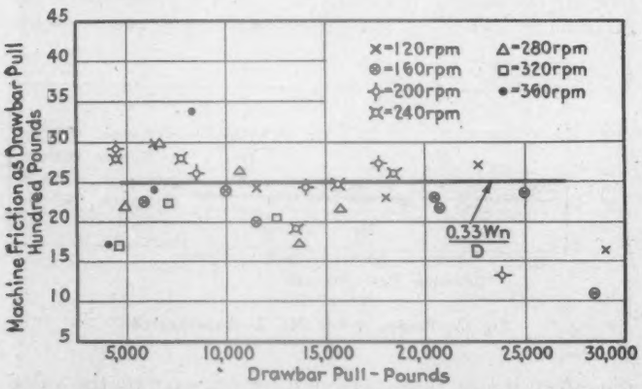


Fig. 5—Pennsylvania 4-6-2, Class K4s No. 1737—Bulletin No. 29

to the foregoing conclusions, but some details of the plots deserve discussion.

In the majority of the plots the individual points show no change in machine friction as the drawbar pull increases. In one case, however (Fig. 10), there is a tendency for the machine friction to drop as the drawbar pull is increased. Two other cases (Figs. 6 and 11) show a reverse effect, the tendency being for the machine friction to rise as the drawbar pull is increased. It is believed that these variations from the horizontal are accidental. In Fig. 4 the omission of four or five tests at low rates of drawbar pull would level off the plot.

Figs. 6 and 11 showing a tendency for friction to rise as drawbar pull is increased represent, respectively, a 2-8-0 locomotive on the University of Illinois plant and a 2-10-0 locomotive on the Altoona plant. The tests of the 2-8-0, 2-8-2 and 4-8-2 locomotives represented by Figs. 7, 8, 9 and 10 indicate that this rise in friction with increasing drawbar pull is not typical.

The very large deviation shown in all of the test groups expresses the difficulty of measuring the machine friction with any high degree of precision. It cannot be measured directly but is found by determining the indicated cylinder tractive force and deducting from this the drawbar pull measured by the dynamometer. The resulting difference is small compared with the measured quantities. If the friction represents 15 per cent of the drawbar pull an uncertainty of 3 per cent in the indicator cards will mean an uncertainty of 20 per cent in the friction. Indicator cards are not likely to be more precise than this and at least a similar lack of precision must be counted on for the dynamometer. Therefore even under

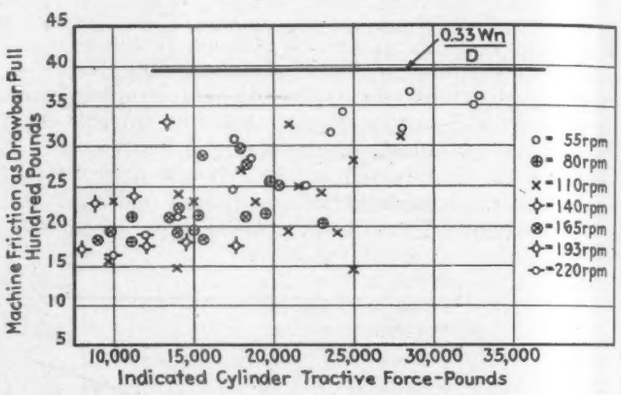


Fig. 6—Illinois University 2-8-0—Bulletin No. 82

favorable conditions an uncertainty of 40 per cent in the value of the friction will be normal.

Form of the Equation

The form chosen for Equation (1) is based on the following considerations:

1—The value of the friction drawbar pull must bear some relation to the size of the locomotive, or more directly to the dimensions of cylinders and machinery parts. It is believed that this size effect can be taken into account with reasonable accuracy by assuming that there is direct proportionality to the total weight on driving wheels.

2—The experimental data shows that the friction drawbar pull increases more rapidly than the weight on drivers. It is thought that this can be taken into account by assuming direct proportionality to the number of coupled wheels.

3—The frictional resistance to movement of the machinery originates at the circumference of the driving journals, at the crank pins and in the reciprocating parts

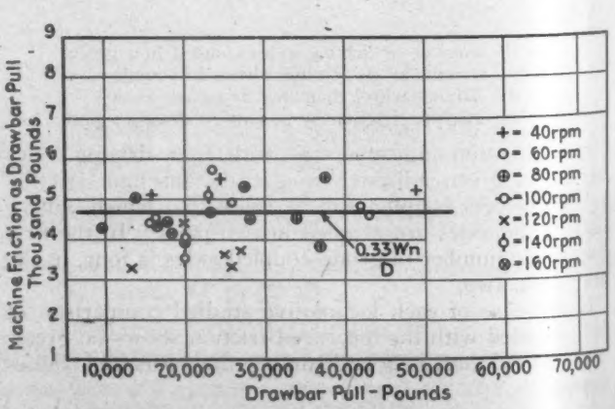


Fig. 7—Pennsylvania 2-8-0, Class Hbsb No. 387—Bulletin No. 10

attached to the crank pins. This resistance is translated into drawbar pull through the leverage of the driving wheel radius. It is therefore reasonable to assume that the friction drawbar pull is inversely proportional to the driving wheel diameter. It might be argued that the driving journal diameters and the stroke should be brought into account. This may be theoretically true, but the experimental data is not precise enough to justify an attempt in this direction.

Derivation of the Equation

Having assumed that the machine friction could be expressed by an expression of the form of equation (1),

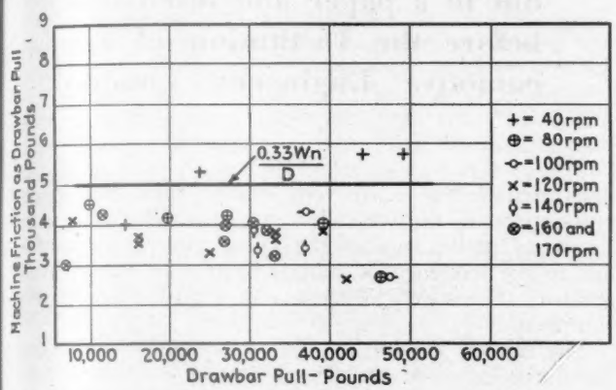


Fig. 8—Pennsylvania 2-8-2, Class L1s No. 1752—Bulletin No. 28

the ten plots, Figs. 2 to 11, were used to determine the value of the numerical coefficient. If this coefficient is represented by k, Equation (1) becomes

$$F = \frac{k \cdot n \cdot W}{D} \quad \text{.....(1a)}$$

$$k = \frac{F \cdot D}{n \cdot W} \quad \text{.....(2)}$$

In each graph a value was selected for representative of the plotted values of the friction which correspond to the

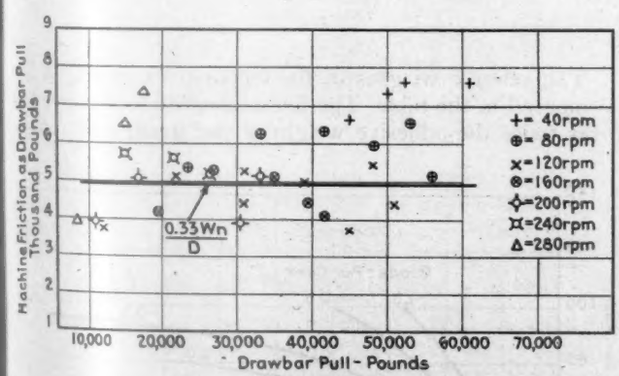


Fig. 9—Pennsylvania 4-8-2, Class M1 No. 6872—Test report June 6, 1929

normal working drawbar pull of the locomotive. These values of F are given in column 7 of Table 1. From these figures values of k were computed by Equation (2). These values are given in column 8. The average of the ten values thus found for k is 0.330 and this value has been used in Equation (1).

As a further check, Fig. 1 was plotted. Ordinates represent the values of F derived from the plots (Col. 7, Table 1), multiplied by the driving-wheel diameter. This product represents the torque lost in friction. Abscissae are the values obtained by multiplying the weight on drivers by the number of axles coupled in a group. If the relation of Equation (1) is true, the values plotted in

Table I—Dimensions of Locomotives

1	2	3	4	5	6	7	8	9
						From plot		$F = \frac{0.33\,nW}{D}$
Fig.	Loco. type	Test plant	Loco-Motive design-nation	Wt. on drivers, lb.	Driv. wh'l. dia., in.	F	k	D
2	4-4-0	Purdue	No. 2	61000	69	580	0.327	585
3	4-4-2	Altoona	E6s No. 51	101000	80	1500	0.425	1260
4	4-6-2	Altoona	K2s No. 877	180000	80	2250	0.333	2230
5	4-6-2	Altoona	K4s No. 1737	203000	80	2400	0.315	2500
6	2-8-0	U. of Ill.	.....	201000	63	3400	0.266	3900
7	2-8-0	Altoona	H8bs No. 387	219000	62	4700	0.334	4650
8	2-8-2	Altoona	L1s No. 1752	236000	62	3700	0.243	5000
9	4-8-2	Altoona	M1 No. 6872	267000	72	5700	0.386	4900
10	4-8-2	Altoona	M1a No. 6706	271000	72	3700	0.247	4950
11	2-10-0	Altoona	I1s No. 790	342000	62	10000	0.362	9100
			Average				0.330	

Fig. 1 should fall on a straight line having the slope 0.33. It will be seen that this line gives a conservative representation of the plotted points.

In studying existing reports of measurements of loco-

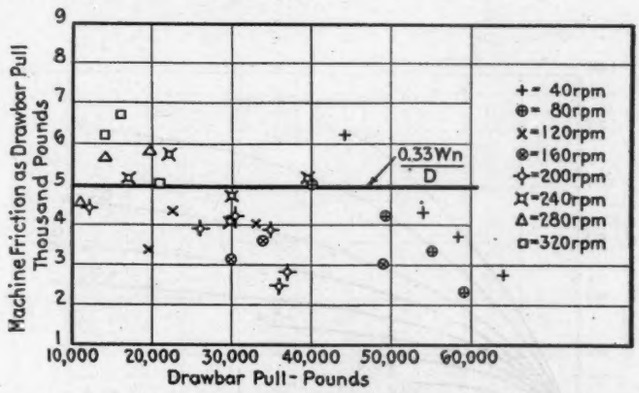


Fig. 10—Pennsylvania 4-8-2, Class M1a No. 6706—Test report March 8, 1932

motive machine friction it must be understood that an individual measurement may not have a high degree of precision. It is believed, however, that the large mass

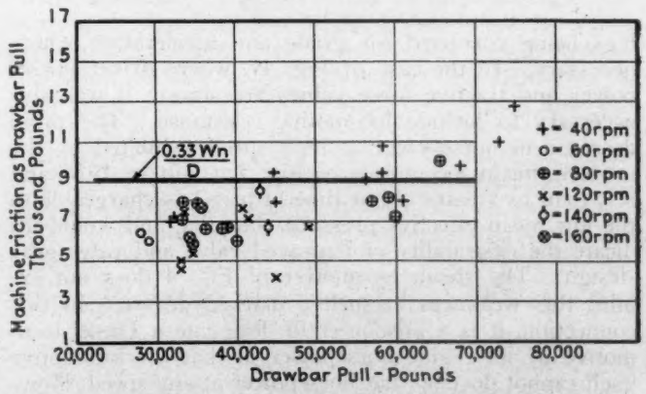


Fig. 11—Pennsylvania 2-10-0, Class I1s No. 790—Bulletin No. 31

of data considered provides reasonably accurate figures as to the friction which may be expected in any given locomotive.

Acknowledgment is made of the courtesy of H. W. Jones, chief of motive power, Pennsylvania, for permitting the use of data from the Altoona locomotive testing plant.

Diesel or Steam Power?

By L. K. Sillcox*

An amplification of many of the more important points brought out in a paper and discussion before the Institution of Locomotive Engineers, London

IN THE January, 1943, issue of *Railway Mechanical Engineer*, page 29, appeared an abstract of a paper by Mr. Sillcox presented before the Institution of Locomotive Engineers, London, England. The paper brought forth considerable discussion, largely in the form of questions soliciting the amplification of numerous points. The information contained in the author's closure is of such general interest that it is presented herewith, in abstract. The author, in stating why the information is offered, makes the nature of the question obvious.—EDITOR.

Derivation of Locomotive Data

A question has been raised relative to the manner in which the horsepower values presented were obtained, which are, incidentally, sustained. They are the result of road tests with dynamometer car, the measured readings being corrected for grade and acceleration where necessary. In the case of Fig. 4†, where driver horsepower and tractive force values are shown, it was also necessary to include locomotive resistance. The rapid decrease in horsepower at high speed exhibited by the modern steam locomotive of Fig. 1 (built in 1938 and less than two years old at time of tests) is chargeable to the low mean effective pressure obtaining and would indicate the desirability of improved valve and valve gear design. The steam locomotive of Fig. 4 does not exhibit this weakness to such a marked degree. In this connection, it is a misnomer to designate a Diesel locomotive by its engine horsepower in that the locomotive itself cannot develop that horsepower at any speed. However, that fact is clearly appreciated and such method of designation provides a convenient and uniform basis for a nominal rating.

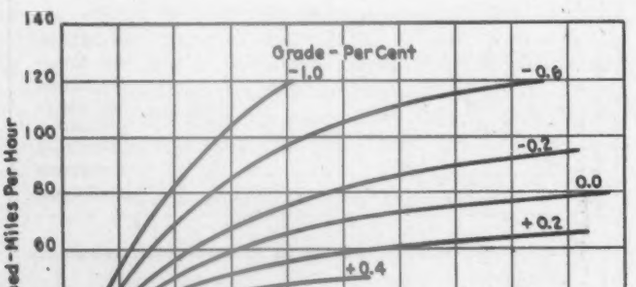


Fig. 6—Speed-time curves for 4,000-hp. Diesel-electric passenger locomotive hauling 1,250-ton train on various grades

While the locomotives whose tractive force and horsepower characteristics are graphically presented in Fig. 1 and those whose accelerating characteristics are likewise illustrated in Fig. 3 are very similar, they are different units operating on two railways. Especially close is this similarity in the case of the Diesel-electric locomotives due to the tendency of standardization in Diesel manufacture. The steam locomotive of Fig. 3 is not booster-equipped.

The railway submitting Fig. 4 explains that the tractive force curve of the Diesel-electric is driver tractive force while that of the steam locomotive is that obtaining at the cylinders inasmuch as that is standard practice on that system.

Weight Comparison of Steam and Diesel-Electric Locomotives

4-8-4 STEAM LOCOMOTIVE

Weight on drivers, lb.	270,000
Total engine, lb.	483,000
Tender, lb.	406,500
Total, lb.	889,500

5,400-HP. DIESEL ELECTRIC

24,690 lb. ea. on 24 driving wheels	= 592,560 lb.
23,730 lb. ea. on 12 idle wheels	= 284,760 lb.
Total	877,320 lb.

The relative weights of the locomotives of Fig. 4 are compared in the table. The Diesel-electric locomotive has over twice the adhesive weight of the steam unit. Also,

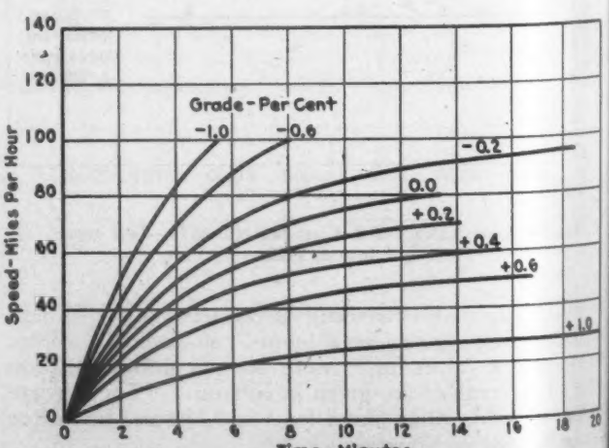


Fig. 7—Speed-time curves for 4-6-4 type steam passenger locomotive hauling 1,250-ton train on various grades—Locomotive tractive force 49,500 lb.; weight on drivers 213,440 lb.

* First vice-president, New York Air Brake Company.

† Figs. 1 to 5 inclusive appeared in the January, 1943 issue and to avoid confusion the charts accompanying this article are numbered Figs. 6 to 12, inclusive.—EDITOR.

since it can support a higher adhesion factor due to its more even torque, this advantage is still further enhanced.

Steam Helpers on Diesel Powered Trains

In so far as steam helpers on Diesel-powered trains are concerned, the condition is no different from that obtaining if a steam locomotive were assigned to the service. It is as uneconomical to power a train sufficiently to enable traversing the steep grades of the Rocky or Allegheny Mountains with one type motive power as another. Trains operating from Chicago to the Pacific Coast or via the southern route from New York to Chicago encounter difficult grades for comparatively short distances with much level or rolling territory throughout the remainder of the runs. In such instances we observe the apparently incongruous spectacle of a steam locomotive at the head of a Diesel-powered train on ruling grades without considering that possibly two helpers would have been required if steam power were employed exclusively.

Load Factor of Diesel Powered Trains

Information has been requested relative to the load factor of Diesel-powered trains and to the center of gravity of those trains. The table presents representative data in reply to both. Some of the preceding train consists have been revised, both in respect to number of cars and installed horsepower, since the above were obtained but the load factor has not changed materially.

Data on Diesel Load Factors and Centers of Gravity

Train Name	No. of cars	Total train wt., tons	Total hp.	Lb. per hp.	Center of gravity, in. Power unit	Cars
City of Los Angeles, No. 1	11	665	4,000	333	52	49
Twin City Zephyr	7	380	1,800	422	57	52
Super Chief	9	796	3,600	442	57	55
City of Portland	8	468	2,100	446	52	49
City of Los Angeles, No. 2	14	1,256	5,400	465	57	55
City of San Francisco	14	1,273	5,400	472	57	55
Sam Houston Zephyr	4	144	600	480	52.5	48
Pioneer Zephyr	4	151	600	503	52.5	48
Golden Gate	6	456	1,800	507	57	55
Denver Zephyr	12	782	3,000	521	57	52
General Pershing Zephyr	4	270	1,000	540	52.5	48
San Diegan	7	500	1,800	555	57	55
City of Denver	11	729	2,400	608	52	52.5
Average	..	....	....	484	54.8	51.8

The centers of gravity of standard equipment vary somewhat but 56 inches and 78 inches are typical values for passenger cars and steam locomotives, respectively.

Calculation of Tractive Force Curves

The tractive force curves of Fig. 5 are those used by a company considering Dieselizing one of its yards and were taken from the study prepared in that connection. Obviously, the steam locomotive curves are calculated by some formula which compensates for the effect of speed other than the conventional speed factor. In so far as adhesive limits are concerned, steam locomotives are ordinarily designed to produce a maximum tractive force which will be supported by a 25 per cent coefficient of adhesion while, due to the more even torque, the corresponding value for a Diesel-electric is assumed to be 30 per cent, and upon this percentage the rated tractive force is determined. This is true in the case in question. In this instance the steam locomotives could not exert a tractive force equal to 25 per cent of weight on drivers, the tractive force being calculated from the common equation,

$$T = \frac{0.85\ Pd^2s}{D}$$

where

P = boiler pressure, lb. per sq. in.
0.85 P = assumed cylinder pressure, lb. per sq. in.
d = cylinder diameter, in.
s = stroke, in.
D = diameter of drivers, in.

The author does not feel that the higher acceleration possible with a Diesel-electric switching locomotive is an

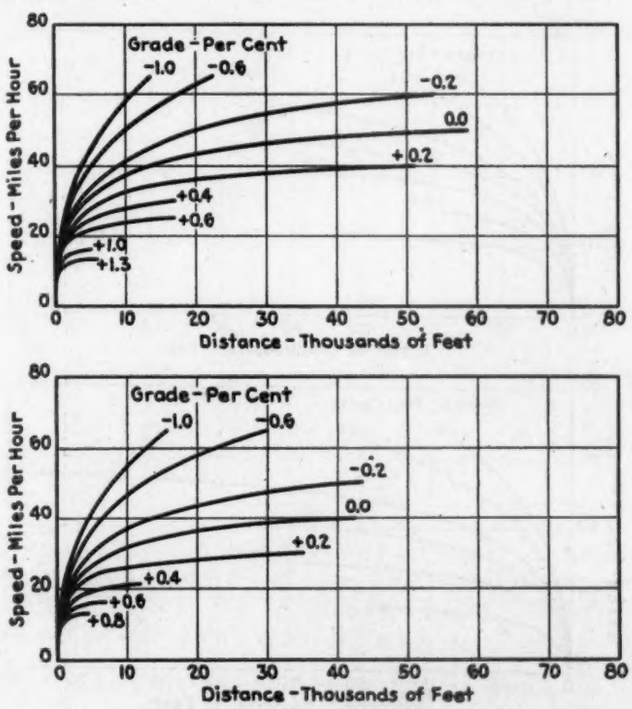


Fig. 8—Speed-distance curves showing the distance required to accelerate a 4,000-ton freight train—(Top chart) hauled by a 5,400-hp. Diesel-electric freight locomotive on various grades; lower chart shows similar curves for a 6,000-ton train

inherent source of damage to cars or their lading. The constant torque displayed by the Diesel provides smooth uniform acceleration, free from the fluctuating force of the steam locomotive, and thus it is less damaging to draft gear. In so far as damage from impact upon release is concerned, it appears that the judgment of the engineman must be relied upon irrespective of power type. The advantage exhibited by the Diesel is in attaining a given speed more quickly, not in attaining a higher speed than that of its steam counterpart. Uncoupling speed need not vary with power type.

Operating Mileages of Freight and Passenger Runs

The high average annual mileages of 250,000 and 180,000 indicated for the passenger Diesel-electric and steam locomotives, respectively, are not indicative of the general average in the United States since Diesel-electrics are assigned mainly to runs of considerable length, such as Chicago to the Pacific Coast, and the mileages accumulated by steam locomotives in the same services were selected for comparative purposes. A western transcontinental railway, the A. T. & S. F., has released selected steam locomotive utilization data which are of interest.

A. T. & S. F. Steam Locomotive Mileage for July, 1942—Through Service

Passenger:	
Average, total	9,928
Individual run, maximum	15,382
Individual locomotive, maximum	20,290
Freight:	
Average, total	6,166
Individual run, maximum	9,015
Individual locomotive, maximum	10,397

While steam switching locomotives are assigned, in so far as traffic conditions will permit, to 24 hour continuous periods of duty, the system utilization is but approx-

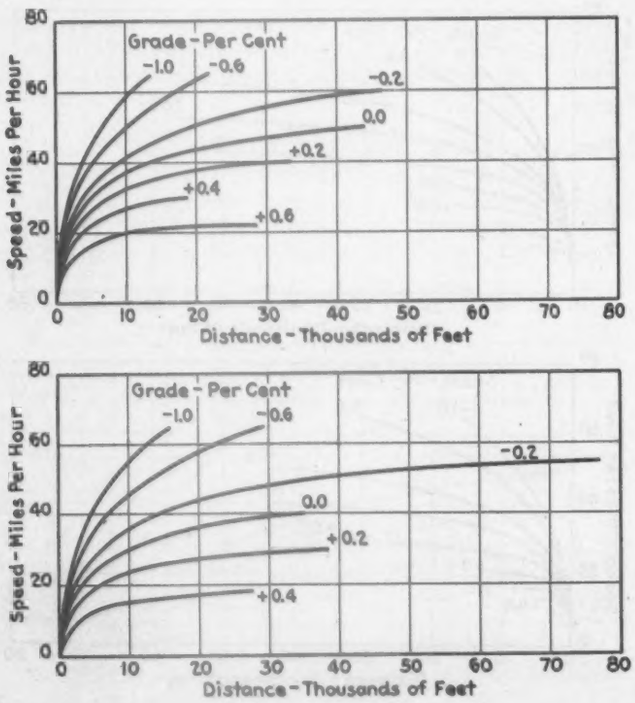


Fig. 9—Speed-distance curves for a 2-10-4 type steam freight locomotive having a tractive force of 93,000 lb. and a weight on drivers of 371,990 lb.—The upper chart shows the distances required to accelerate a 4,000-ton train and the lower chart is for a 6,000-ton train

imately 67 per cent. It should be added here that it is the "practice to give preference to the use of Diesel locomotives when both steam and Diesel power are assigned, in order to get maximum utilization of the Diesels, resulting in some loss of mileage to steam locomotives." The result is a utilization of 92 per cent for Diesel switching power. Rarely is the attempt made in this country to operate a steam switching locomotive over 24 hours without return to the enginehouse and many railways prefer the 16-hour maximum. The tendency toward longer periods of activity is increasing, however, and the higher maximum is becoming more frequently respected.

A Definition of Availability

Availability as used in the paper is defined as the percentage of total time the unit is available for service, while utilization is the percentage of the total time it is assigned to duty. For example, if a switching locomotive is assigned to but two of the three eight-hour shifts per day and four hours are required for servicing and light repair, that unit's availability would be 83.3 per cent but its utilization would be but 66.7 per cent through no fault of the locomotive.

Why Not Mechanical Transmissions?

A major reason that the mechanical transmission has not been more popular in the United States is the large power units in operation. Mechanical transmission has been applied successfully to light rail cars but the high stresses in gear trains associated with road units have discouraged its use. While electric transmission is high in first cost and relatively heavy, its adaptability lends itself to freedom in layout and is excellently suited for the remote control necessary for multiple unit operation. Dynamic braking in descending long grades, obtained with electric transmission, is a distinct advantage in mountainous territory and results in a reduction in wheel and brake shoe wear, and wheel damage, due to lessening the demands upon the air brake system. The practice of nose suspending traction motors on Diesel locomotive trucks does lower the center of gravity from the height which it would occupy if flexible drives were employed and higher lateral rail stresses are a consequence. However, it is judged that the advantages of the low center of gravity fully compensate for this detrimental feature. Here again the high power values to be transmitted in the large units employed operate to the disadvantage of flexible drive mechanisms although, admittedly, they exhibit beneficial characteristics. The bogie type truck with traction motors mounted thereon is preferred in this country in that the center of gravity is maintained lower than could be possible with quill drive and, as the motors would be mounted high, they would interfere with equipment and accessory space in the cab. The present design also permits a truck to be removed as a unit and another substituted quickly for maintenance with a mini-

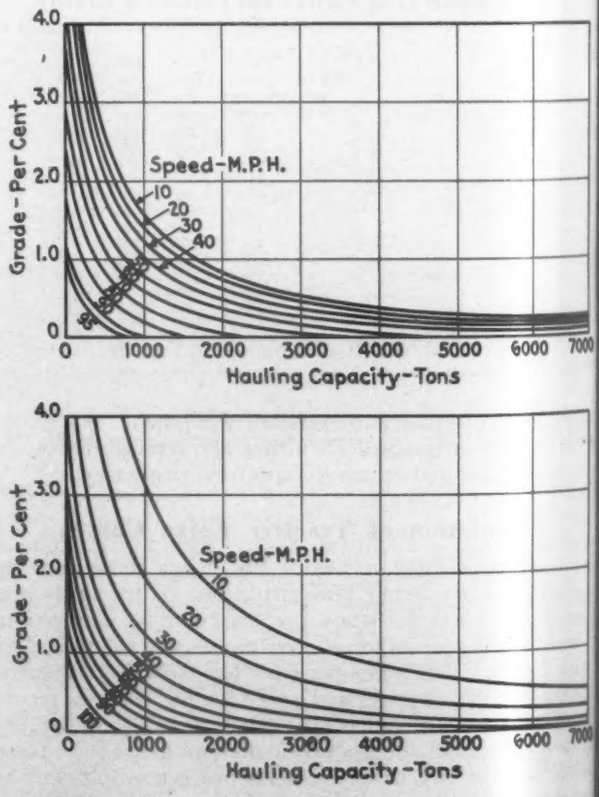


Fig. 10—Hauling capacity curves for trains consisting of 90-ton cars. The upper chart shows a group of curves for a 4-6-4 type steam passenger locomotive having a tractive force of 49,500 lb. and weight on drivers of 213,440 lb.; the lower chart shows similar curves for a 4,000 hp. Diesel-electric passenger locomotive having a tractive force of 107,850 lb. and a weight on drivers of 422,100 lb.

mum delay. Furthermore, the independent bogie trucks restrict the rigid wheel base to that of a four- or six-wheel truck.

Operating Costs and Mechanical Failures

The locomotive labor costs were submitted as complete. As previously stated, all railways do not carry a third man, maintainer, on their Diesel-electric locomotives and, when done, it is customary practice either to carry this cost in a separate account or to add it to maintenance labor. There is one disconcerting factor which is difficult of evaluation and that is the practice of manufacturer's representatives riding the Diesel-electric units, especially when new or when a railway is just initiating the new power type, without cost to the railway. This factor vanishes however as the railway maintenance force becomes trained or the Diesel unit accumulates mileage. In so far as maintenance en route, only minor inspection and repairs can be thus accomplished. Railways which observe the practice of providing a member of the maintenance force on all Diesel runs feel the expense is justified in that it is insurance against road failures and reduces terminal maintenance time since the maintainer is fully aware of what repair or inspection is necessary and the work can be initiated without delay. Difficulty has not been experienced in this country in obtaining qualified enginemen for assignment to Diesel-electric operation, but a short period of training being necessary. As stated, practice of carrying maintainers is not universal and, when not carried, the operator, or his "fireman," must service the equipment en route, hence the training is necessarily more extended. In some instances, labor union agreements or state laws preclude dispensing with the "fireman" and in such cases no labor saving accrues from this source. This statement, of course, applies only to yard service. The "fireman" is never dispensed with in road service.

It is true that special facilities are required for Diesel locomotive maintenance and that the duplication has increased costs. This question involves the opposing views as expressed during the discussion. One view is that, with the two types of motive power, duplicate facilities are required—that steam maintenance and servicing equipment must be maintained as long as any steam power remains—and that the savings accruing to Diesel-electric power are therefore materially reduced. This cannot be denied. The opposing view is that in most parts of the world the Diesel can only be complementary to steam or electric systems and full Dieselization is impossible. Speaking only for the United States, there is no inherent reason why the Diesel-electric cannot produce all the transportation on selected railways. However, in the middle of the traffic scale where a unit can be utilized for but 8 to 12 hours per day, overhead costs will overcome operating savings and, in this case, the economic study would necessarily be section-wide or system-wide in scope. Obviously, each individual case would present its own peculiar problems and would require close study before a decision could be rendered.

The claimed Diesel advantage of eliminating the monthly boiler wash mandatory with steam power was challenged during the discussion on the basis that cylinder maintenance is an offsetting factor. Illustrative of experience in this country, one railway removes and reconditions for reapplication Diesel engine cylinder liners when worn 0.020 in. every 325,000 miles, or, on the basis of an average annual mileage of 250,000, every 15.6 months. Cylinder heads are reconditioned every 100,000 miles or 4.8 months. This same railway reports it is obtaining approximately 84,000 miles between machining of truck wheels—slightly over four months of operation—for a total service life of about 250,000 miles.

Analysis of Part Failures of Diesel Engines

Name of Part	Percentage of failures: Of each part	Cumulative
Bearings	30.0	30.0
Cylinders (including heads and liners)	24.3	54.3
Pistons and piston rings	15.3	69.6
Valves	7.3	76.9
Crankshafts	4.5	81.4
Connecting rods and crankbolts	4.5	85.9
Gears	4.5	90.4
Fuel pumps and piping	2.8	93.2
Governor parts	2.8	96.0
Exhaust manifolds	2.3	98.3
Miscellaneous	1.7	100.0

Cost of Steam Locomotive Repairs Per Horsepower Unit*

(Based upon 10,983 locomotives and 26,401 locomotive repair years)

Year of age	Cost per hp. unit	Year of age	Cost per hp. unit
1	$.430	26	$1.572
2	.720	27	1.603
3	.868	28	1.634
4	.899	29	1.664
5	.930	30	1.695
6	.960	31	1.725
7	.991	32	1.756
8	1.022	33	1.786
9	1.052	34	1.817
10	1.083	35	1.847
11	1.113	36	1.878
12	1.144	37	1.909
13	1.175	38	1.939
14	1.205	39	1.970
15	1,236	40	2.000
16	1.266	41	2.031
17	1.297	42	2,062
18	1.328	43	2.092
19	1.358	44	2.123
20	1.389	45	2.153
21	1.419	46	2.184
22	1.450	47	2.215
23	1.481	48	2.245
24	1.511	49	2.276
25	1.542	50	2.306

* Defined as 10,000 hp.-hrs.

One analysis of Diesel-engine part failures developed the percentages shown in the table.

The Influence of Age on Repair Costs

A table presents the results of a comprehensive study of road steam locomotive repair costs to indicate the effect of age.

The Question of First Cost

While it is true that an improved market and increased costs have exerted their influence upon steam locomotive purchase prices, a major effect has been refinement in design such as the utilization of improved alloys of greater strength, roller bearings, etc. The marked difference in original cost favoring steam over Diesel is an advantage which steam locomotive builders wish to maintain as wide as practicable, hence the tendency is to keep steam locomotive costs at a minimum.

There was no intention to imply that the switching locomotive evaluated was of the 4-8-8-4 wheel arrangement since even in America locomotives of this size are not assigned to switching services. The 4-8-8-4 locomotive referred to as costing $35.00 per hp. is a mainline freight and passenger locomotive designed for heavy, fast operation, while the switching locomotive is rated at 1,400 hp., with wheel arrangement unspecified. Utilization of the same unit price per horsepower when calculating switching locomotive and road power prices is questioned on the grounds that, since the switching locomotive is of a more simple design, its unit cost should be less. The error involved is in the opposite direction in that switching power weighs considerably more per horsepower and is therefore more expensive on this ba-

sis. On a weight basis, a survey of representative locomotive costs by the Railroad Division, American Society of Mechanical Engineers, developed the following for lo-

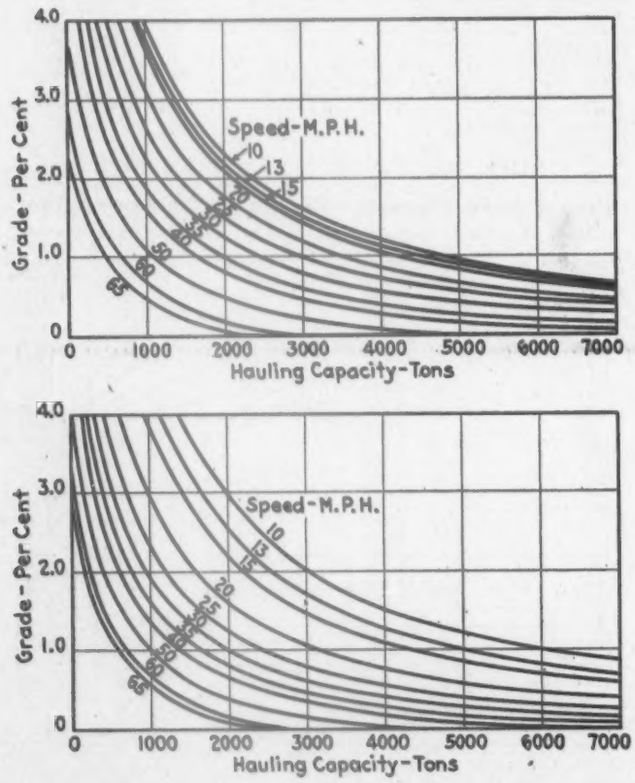


Fig. 11—Hauling capacity curves for trains of 40-ton cars—The upper chart is a group of curves, at various speeds, for a 4-8-8-4 type simple Mallet locomotive of 137,000 lb. tractive force and 540,000 lb. weight on drivers—The lower chart shows a similar group of curves for a 5,400-hp. Diesel-electric freight locomotive weighing 920,000 lb. on drivers and having a tractive force of 225,000 lb.

comotive types treated in the paper: 4-8-4 steam road locomotive, 37 cents per lb.; 0-8-0 steam switching locomotive, 30 cents per lb.; 660-hp. Diesel-electric switchers, 31 cents per lb. These are based on weight of locomotive only, in working order.

The weight of the 4-8-4, 5,000-nominal cylinder horse-

Actual First Costs of Diesel Locomotives Per Unit of Power Output

Hp.	No. of loco.	Cost per horsepower		
		Max.	Min.	Average
360	10	$101.50	$100.80	$101.00
380	18	96.60	89.50	93.50
400	7	109.00	109.00	109.00
600	12	102.50	100.50	101.30
660	19	91.60	91.00	91.10
1,000	44	84.60	78.50	79.00
	110	$109.00	$78.50	$89.80

Unit First Costs of Locomotives Shown in Fig. 5

	Hp. or weight	Unit cost	Total cost
Diesels			
A	1,200	$87.50	$105,000
	340,000	0.31	105,400
B	900	87.50	78,750
	233,500	0.31	72,385
C	600	87.50	52,500
	216,000	0.31	66,960
0-8-0 Locomotives			
N	2,100	$35.00	$73,500
	248,000	0.30	74,400
O	1,500	35.00	52,500
	220,000	0.30	66,000

power from which the curves of Fig. 4 are derived is 483,000 lb. Applying the 37 cents per pound unit cost, a total cost for this locomotive of $178,710 is obtained, or $35.74 per horsepower. Inasmuch as unit pound cost is available for only the 660-hp. Diesel, that price is used in the table. It will be noted that in one instance the horsepower basis produces the higher cost, in another that utilization of the weight basis results in the higher cost, while in the third there is, for practical purposes, no difference. In each case, the horsepower basis is the more conservative.

Actual costs of Diesel switching locomotives purchased during 1941 are shown in another table. It will be noted that 60 per cent of the total are more expensive than the $87.50 unit cost used in the comparison of capital charges and that only the 1,000-horsepower design is less costly.

Why The Electric Locomotive Was Not Discussed

The dismissal of the electric locomotive with but slight reference was occasioned by the purpose of the paper, to evaluate the comparative characteristics of steam and Diesel-electric power. The steam-electric controversy has been so thoroughly covered by many writers that it was not injected in this study. The only reason that electric traction was referred to at all was to demonstrate that the line of demarcation between steam and electric

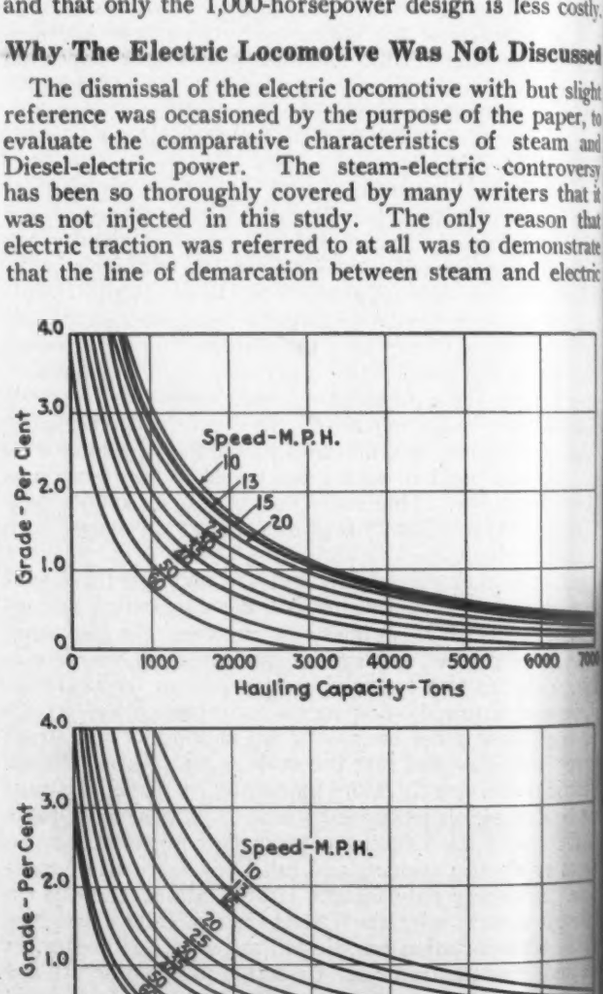


Fig. 12—Hauling capacity curves for freight trains of 40-ton cars at various speeds—The upper chart is for a 2-10-4 type steam freight locomotive having a tractive force of 93,000 lb. and a weight on drivers of 371,990 lb.; the lower chart is for a 4,050-hp. Diesel-electric freight locomotive having a tractive force of 168,750 lb. and weighing 690,000 lb. on drivers

power is more clearly marked than between the steam locomotive and its Diesel-powered competitor. Neither was density of traffic ignored as a justification for electrification since examples were cited where traffic considerations prompted the installation of electrified serv-

(*Continued on page 212*)

B. & O. Simplifies Diners

Change reduces maintenance, increases capacity and prepares for future improvements

FACED with the need of redecorating and reconditioning its twenty Colonial diners, the Baltimore & Ohio decided to simplify the interior design and dispense with furniture and fittings for which replacements are now not available or very difficult to obtain. The ingenuity of the designers has produced a beautiful interior which has the advantage of low cost and less maintenance.

The cars, which were built in 1926, were fitted with hand-carved chairs of Colonial pattern. These have been replaced with chairs of relatively simple design, costing less than one-third of those they replaced. Originally the windows had multiple interior panes with arched mirrors above and leaded glass in the inner sash. These have been replaced with plain double windows. Elaborate egg and dart moulding has been replaced with plain and other decorations have been similarly simplified.

The cars have been painted, inside and out, new drapes hung at the windows, the floor recarpeted, new chairs and tables installed and new lighting fixtures added. The seating capacity has been increased. The diners formerly had four-seat tables at one side and two-seat tables on the other, making a total of 36 seats. Four-seat tables are now used on both sides, seating a total of 48.

The interior has been repainted with Dulux. The ceilings are oyster white, the upper side walls and panels are buff with beige trim, the lower side walls are tan and the mouldings of the panels between and above windows are oyster white. The bulkheads and buffet panels are blue with oyster white moulding.

The pantasote shades are a peach color on the inside, while the drapes have a blue flower pattern with white linen back. The chair coverings are Normandy blue Grospoint. The Bigelow Sanford Consort grade carpets are figured and mulberry in tone.

The lighting fixtures in the dining section have been changed to two continuous lighting units at the sides of the deck sills. These replace the Colonial design center

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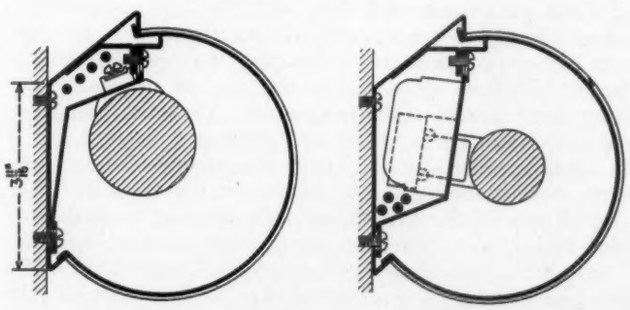
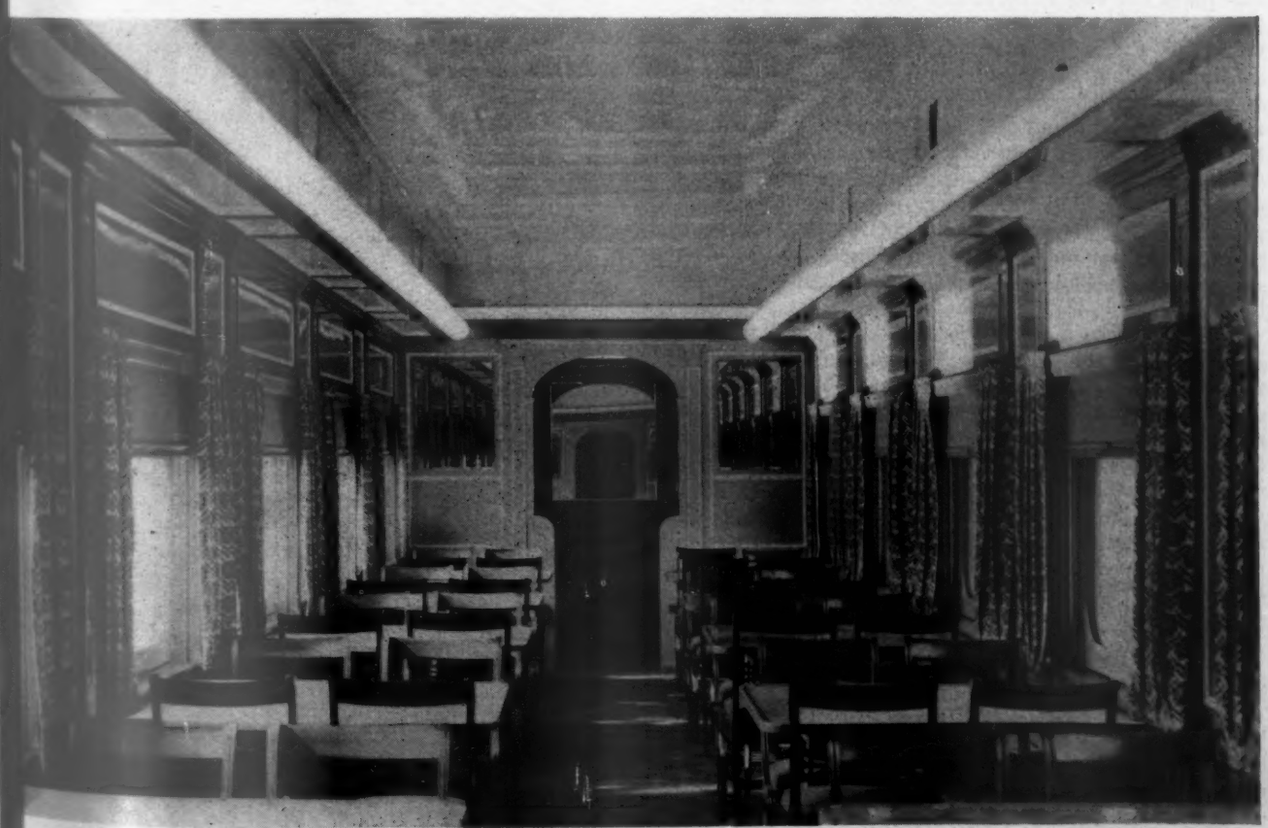


A sectional view of one of the lighting fixtures showing how the reflector may be used for either incandescent or fluorescent lamps



Interior of one of the converted diners

Riding Quality Improved by

Snubbers on Freight-Car Trucks*

By Goodrich A. Lewis†

Higher-speed operation without danger to car or track—Car lading protected—Proper understanding of function needed —A. A. R. 1940 report questioned

SNUBBERS are now generally recognized as a very necessary part of the anatomy of the modern freight car. How they improve riding quality is a comparatively simple proposition in practical mechanics. The improvement effected by snubbers is almost unbelievable until, in connection with service tests, personal comparison is made of the riding quality of a pair of freight cars of identical design and load, one equipped with coil springs and the other having one coil in each of the four nests replaced by a snubber. Trying to sit on top of an unsnubbed 50-ton load of coal at a speed of about 50 m. p. h. was an unforgettable experience afforded in 1933, when one of the railroads found that a new venture in overnight fast freight operation was collapsing the arch bar trucks of these particular coal cars, and the occasional truck failures were causing expensive derailments. These coal cars had never given any particular trouble with operation at ordinary speed but in this special service everything went wrong with the trucks. The rock-ballasted, heavy-rail track was of the very best and entirely suited for high speed traffic, so the management blamed deficient maintenance and inspection for the trouble. The best efforts of the car department effected no improvement and the cars bounced just as badly as ever. Stronger cast steel trucks seemed out of the question for such old coal cars and experimentation with snubbers was suggested.

What the instruments showed about the relative riding quality of two adjacently coupled freight cars was in line with the fact that the observers found no discomfort riding on the wooden bench of the car equipped with snubbers, while in the car with the full complement of 16 double coil springs of the A. A. R. 1915 design the ride was most uncomfortable. The observers noted that the unsnubbed car bounced very badly during 96 min. of the 219-min. test trip, and with such violence that one could hear, above the noise of operation, the repeated pounding of the weight of the loaded car on the solid springs. This trouble was never present on the adjacent car where one double coil of each nest had been replaced by a snubber.

The excessive amount of bouncing was definitely associated with the fact that so much of the speed was above 45 m. p. h. and near the critical speed which was conducive to harmonic amplification of the vertical movement on the springs. This meant that, regardless of the fine condition of the track, there was a slight vertical impulse at every rail joint, and the recurrence of these very gentle impulses got in step with the natural vibration frequency of the coil springs, amplifying the oscillation and sustaining it at such a high level of violent bounce that only by the springs going solid was it interrupted.

Frequency of Oscillation

Natural frequency is the rate at which the freight car body oscillates vertically on its springs. Vertical disturbance means oscillation at some definite number of reciprocations per second. The frequency depends upon the superimposed weight. Doubling the weight lowers the frequency. It is also lowered by reducing the stiffness of the springs.

Freight-car springs produce a car bounce frequency in the general range between five and three oscillations per second decreasing from higher frequency to lower as the compression on the springs is increased by the weight increase from empty to capacity load. Freight-car frequencies are relatively higher than those of passenger cars where, due to the slight difference between empty and loaded weight, the resistance per inch of spring deflection can be much lower and the action softer.

The A. A. R. report of 1940, describing performance of high-speed freight trucks, contains the following fundamental statements regarding riding quality:

1—Soft springs are one of the requirements.

2—There must be a certain amount of absorption in the spring system to dampen the motion quickly.

3—Spring systems must be lively and capable of making the wheels follow the rails with as little variation as possible in wheel pressure on the rail.

Anyone who has studied the wheel action of a rapidly moving modern automobile or railroad passenger car can subscribe to these statements. The fine vertical riding quality and almost total freedom from shock result because the body remains substantially quiescent with reference to any local road or track roughness. This is made possible because the spring and snubbing systems are very sensitive and active. The best ride condition results from the use of springs with the softest possible action. Ideal softness presumes the lowest possible ultimate spring resistance consistent with the heaviest load to be carried, which should cause a reasonably high percentage of total deflection. Snubbers of soft action and quick reciprocating ability are vital to good riding quality because they immediately absorb any harmonic tendency in the spring system to develop amplified movement. Unsnubbed body bounce above the springs competes with the movement necessary below the springs to accommodate an uneven rail condition. This causes unnecessary shock and tends to make the springs go solid under conditions of full load.

Tank Car Test

A number of years ago, one of the tank car companies determined that the presence of snubbers on one of a pair of tank cars of identical construction permitted the

* Presented before a meeting of the Eastern Car Foremen's Association at New York City on March 12, 1943.

† Chief engineer, W. H. Miner, Inc., Chicago

car weight to compress the springs about 3/16 in. more under full load than on the other car with normal springing. Although it was mechanically obvious that this provision of greater compression would improve riding quality under any load condition, the question came up as to whether the reduced travel and spring capacity below the riding height would impair efficiency because of oversolid springs. A typical 1,000-mile trip for this pair of loaded cars, which involved all varieties of speed and track, showed that the car with the snubbers prevented bounce amplification and consequently no instance of a deflection closer than ¼ in. from solid developed during the entire trip, but the adjacently coupled car with no snubbers went solid on the springs repeatedly.

It is evident that proper snubbing actually permits softer springing. This has been conclusively demonstrated in many other independent experiments in freight and passenger car operation at high speed. Freight car springs, of course, cannot be as soft as passenger car springs because of the very much wider variation between empty and loaded weight on the rail, and the necessity to maintain coupler heights above the rail between the narrow limits of 34½ in. maximum and 31½ in. minimum. Reduction in spring capacity, however, accompanied by adequate, soft and quick-acting snubbing during hundreds of miles of testing, invariably shows reduced maximum deflection below normal riding height and vastly better riding quality than before the correction was made.

A. A. R. Tests

About 12 years ago a large number of 50-ton cars were provided with trucks accommodating six coils per nest instead of four. This was intended to provide the extra capacity necessary to stop springs from going solid because of bouncing at speeds greater than 45 m. p. h. One of the functions of the A. A. R. 1936 or D-2 four-coil nest was to provide 25 per cent more capacity to this same end. Protecting springs from breakage by either method is poor economy because the intensity and frequency of vertical shock is enormously increased and the car structure and lading are punished with much more severity. This was fully demonstrated in the A. A. R. snubber tests of 1933. The fine purpose of the 1936 spring design, however, is its use in the proper combination with commercial snubbers to insure not only freedom from solid springs but the inherently finer riding quality of the original 1915 springs. A good criterion for maximum stiffness for any freight car is to make the ratio of the maximum load to be carried to the ultimate dynamic resistance of the corrected nests at least 61 per cent. This criterion is based on the 50-ton car as it is carried by 16 new double coil springs of 1915 design. The sprung load is 157,000 lb., equal to the maximum weight on the rail of 169,000 lb. minus the weight below the springs of about 12,000 lb. The ultimate resistance of the 16 double coil springs is about 256,000 lb. The ratio of 157,000 to 256,000 is about 61 per cent. Such loading compresses the nest about 1 in. of the total deflection of 1.69 in. Full load is carried below half travel, not above it, as is the case with the present A. A. R. D-2 or 1936 nests.

Snubber Function

The function of the snubber is merely to absorb enough energy per deflection to prevent bounce amplification. As a result, the demand on maximum deflection and total amount of spring movement is enormously reduced. The life and efficiency of the springs are correspondingly improved and it becomes possible to carry the loaded car properly with existing old springs with a great reduction in the number and intensity of vertical shocks which damage car structure and lading. Stabilization permits safe springing of the loaded car with a greater degree of compression, so that the empty or partially loaded car can get more compression, which means less stiffness, more of a floating ride, and improved riding quality.

The bouncing car on good track can be subjected to very severe vertical shock by any interruption of the bounce caused by some track irregularity which would be inconsequential if the car were quiet vertically. Repeated tests on good track have shown that shock sufficient to kick loads from the floor of the car are generated in alarming numbers whenever the unsnubbed car operates at its critical speed. Such shocks mean that the load on the brasses is varying between nothing at all and more than 200 per cent of normal, a very bad condition which is probably related to hot-box trouble.

Snubbers Protect Car and Lading

Tests have shown that the stiffer the car construction and the more noncompressible or immovable the load the more violent is the amplitude of bounce and consequently the greater the number and intensity of the vertical shocks. This is the reason why, under the stress of recent operation, the tank car has proved to be more in need of the stabilization provided by snubbers than any other type of car. The apparent reason for this is that the load of a tank car is noncompressible and its construction is rigid, and consequently there is maximum bounce amplification and shock count as compared with equipment such as box and open-top cars. In such framed structure equipment there is apparently some reduction of bounce amplitude due to the work being done on the car framework and the bouncing load. This explains the recently noted tendency for the bouncing tank car to develop enough vertical shock to unlock couplers while other cars of identical weight, but with less rigid construction and solidity of load, do not do so.

The reduction of spring movement and shock count by snubbing provides definite improvement in the maintenance of many parts of the car besides the springs. Some tank car owners who have had considerable experience with maintenance costs for cars with and without snubbers know that snubbers are worthwhile even though bounce shock has no harmful effect upon fluid loads. There is much evidence that freight claims on commodities subject to breakage by repetition of vertical shock caused by upward acceleration of the car floor, such as for example sewer pipe, furniture, fresh fruits and vegetables, etc., have been reduced by the use of snubbers. Cement hopper cars equipped with snubbers are said to prevent the packing of this product which obviously results from a bouncing car. It was recently reported that the use of snubbers is preventing the displacement and damage of machined projectiles as well as the breakage of floor boards in very high-speed freight service. These results point conclusively to a corresponding reduction of stress and fatigue on parts of the car structure, reduction in the number of waste grabs, etc., which guarantee further profitable investment for reduced cost of maintenance as well as increased operating safety.

Error in A. A. R. 1940 Report

The Association of American Railroads' report, dated April, 1940, entitled "Tests of Trucks for High-Speed Freight Service," is important because it vitally concerns the mechanics and economics of freight train operation.

It again emphasizes, as did the A. A. R. snubber report of 1934, that the standard A. A. R. truck with high capacity standard springs and no specified means for stabilization has very unsatisfactory performance at speeds above 40 miles per hour. The 1940 report is particularly valuable because it proves that standard A. A. R. 50-ton trucks without snubbers and sprung with the latest high capacity 1936 springs developed a dangerously bad riding quality at speeds of from 60 to 85 m. p. h. This report, however, made certain statements which lend the impression that most of the A. A. R. trucks now in service cannot be adjusted to perform safely at very high speed. It is true that the standard A. A. R. truck equipped with four A. A. R. 1936 double coils per nest performed very badly and this, of course, served to exaggerate the good performance of the special softly sprung trucks. But the tests did not include an A. A. R. truck improved by exactly the same mechanics of snubbing and softer springing which the report gives as the reason for the good performance of the special trucks. Inclusion of properly improved A. A. R. trucks in these tests unquestionably would have demonstrated thoroughly stabilized operation at very high speed and prevented the erroneous statement in the 1940 report that snubbers known to give good service at speeds below 60 miles per hour are of little, if any, value at higher speeds. Independent tests, as well as the data of the 1940 report, refute this statement.

One of the trucks in this A. A. R. test had standard A. A. R. construction and included snubbers in the spring systems. Of course, the riding quality was bad because the truck was so unnecessarily oversprung. But such as it was, this riding quality was a tremendous improvement at all speeds above 60 m. p. h. over that of the A. A. R. car having the same spring capacity and no snubbing. Had the spring capacity been reduced from only 49 per cent compression to at least 61 per cent great ride improvement would have occurred and the truck would very probably have been declared to be safe at high speed instead of rejected as unsafe.

The unprecedented train speeds since 1940 have rather definitely proved that the billion-dollar investment in conventional cast steel trucks is fundamentally sound, and that the procedure needed to anticipate the high speed era to come is the program of snubbing now well under way.

B. & O. Simplifies Diners

(*Continued from page 209*)

ceiling and wall bracket fixtures; the cost of reconditioning the old units being sufficient to warrant the new.

The light source in the new fixtures consists of 15-watt lamps, 54 on each side, on 8 5/16-in. centers. Each row is housed in a cylindrical fixture which consists of mounting plates and plastic diffusers made in sections to form a continuous unit. The plastic diffusing sections snap into flanges at the edge of the mounting plates and require no screw fastenings.

The continuous reflector, also made in sections, is an ingenious device. Placed as shown in the left-hand drawing, it is now used to mount the incandescent lamps in angle sockets. When turned over, as shown in the right-hand drawing, the reflector is properly placed for the mounting of 40-watt, 48-in. fluorescent lamps and a space is provided behind the reflector for the fluorescent-lamp auxiliaries. Both sides of the reflector are coated with white heat-resisting enamel and they are punched and tapped for mounting of both incandescent and fluorescent sockets and auxiliaries. The lighting units are mounted so that the lower edges are slightly below the decks to avoid leaving the decks in shadow.

Lighting units in the passageway and over the buffet are also designed so that the present incandescent lamps may be replaced with fluorescent. The lighting equipment was supplied by the Safety Car Heating and Lighting Company.

No changes have been made in trucks, superstructure or the standard Baltimore & Ohio air conditioning with which the cars are equipped.

The work of reconditioning was done in the railroad's shops in Baltimore, Md., under the direction of W. B. Whitsitt, chief engineer, motive power and equipment.

Diesel or Steam Power?

(*Continued from page 208*)

ices. In the United States, where extended distances through sparsely populated territory are common, traffic density will in but few territories economically support the heavy carrying charges incident to electrification. At this point it may be well to emphasize that the author appreciates that many features exhibited by the different power types will not appeal to the engineers of Great Britain as they do in the United States, a striking example being the utilization of oil fuel, especially in the western section of the United States.

Upon What Shall Depreciation Be Based?

The cost data presented are those submitted by the various railways and, for that reason, interest charges are not included, nor depreciation in most instances inasmuch as costs are mainly direct charges to operations. Interest, of course, is dependent upon the amount invested and the money rate which can be obtained. In all but one instance comparative first costs of road power are shown to which may be applied interest rates prevailing at any time or in any country. Depreciation is ever becoming a more controversial issue and a highly questionable one. Shall depreciation be based upon miles, upon years, or a combination of the two? Surely if depreciation is the wearing out of serviceable units—say locomotive miles—utilization will govern depreciation rates, not years—and there is always the spectre of obsolescence. Especially so if Diesel competion forces radical departure from steam locomotive design or if post-war air competition affects the adequacy of both. Calculations based upon mileages operated in 10 months and the mileage depreciation charges for the period, shown in Table V*, indicate that the following approximate service lives are expected: Freight Diesel, 20 years; freight steam, 28 years; passenger Diesel, 12 years; passenger steam, 28 years. Hence 15 years cannot be assumed in all instances.

[An appendix to this closure contained a series of 46 steam-Diesel-electric curves showing (1) speed-time on various grades; (2) speed-distance on various grades; (3) drawbar horsepower-speed; (4) drawbar pull-speed and (5) tonnage capacity at selected speeds on various grades. Figs. 6 to 12, inclusive, accompanying this article are selected from this group of curves.]

* See page 33 of the January, 1943, *Railway Mechanical Engineer.*

Honors

Harry Miller Pflager

Franklin Institute awards the Henderson Medal for achievements in the development of steel castings

HARRY MILLER PFLAGER, senior vice-president of the General Steel Castings Corporation, was awarded the George R. Henderson Medal by the Franklin Institute, at a dinner in Philadelphia on April 21. This medal was established to recognize meritorious inventions or discoveries in the field of railway engineering. The citation for Mr. Pflager indicated that it was for the development of the cast steel one-piece bed for steam locomotives, an outstanding improvement in the modernization of the locomotive. It is typical, however, of many other innovations devised by Mr. Pflager in the evolution of the steel castings industry, and particularly in the art of making large and intricate one-piece castings for railroad equipment. Among his other patents of this type may be mentioned those for four-wheel and six-wheel passenger car trucks, with the truck frames cast in one piece; also making the bottom of the locomotive tender tank an integral part of the cast steel tender frame.

Harry Miller Pflager

Mr. Pflager was born in St. Louis, Mo., November 29, 1866. He attended the public schools in St. Louis and the Manual Training School of that city, which is said to be the first one established in this country. While attending the Manual Training School and, later, while a student in mechanical engineering at Washington University, he worked for the Pullman Company during vacations and week-ends. He was persuaded to take a permanent position with the Pullman Company in Chicago, before completing his university course.

He remained with the Pullman Company until 1901, advancing from draftsman to mechanical inspector at Chicago, assistant superintendent of the shops at St. Louis, chief inspector of the Pullman Company, and mechanical superintendent. He was vice-president and general manager of the American Clock Company from 1901 to 1903 and became assistant vice-president of the American Steel Foundries in 1903. The following year he became associated with Clarence H. Howard, as senior vice-president, in the founding of the Commonwealth Steel Company. He continued in that capacity with the Commonwealth Steel Company and its successor, the General Steel Castings Corporation. Although in his seventy-seventh year, he is still active and has recently devoted his energies to assisting in the development of the cast armor one-piece top hulls for combat tanks, which have been perfected by the engineers of the General Steel Castings Corporation.

Mr. Pflager has visited Europe many times and after the first World War became much interested in the European railways; many European trains were equipped with Commonwealth one-piece trucks and platform castings. He has also visited South America and Africa, and he made a trip around the world in 1931.

He has always taken a keen interest in the welfare and progress of young men, not alone in his own organization, but in the community at large. He has served many terms as a member of the board of directors of the Metropolitan Y. M. C. A. of St. Louis and was at one time its president. He has also been active in the promotion of the Granite City Y. M. C. A., which is located not far from the Commonwealth plant. He is a trustee of Iberia College, Iberia, Mo., an institution established for the farm boys of the Ozark Mountain districts. He is also a trustee of Drury College of Springfield, Mo., which is conducted under the auspices of the Congregational Church.

Psychologists and students of human nature have found that in some instances a man may be equally well fitted for a career as an engineer, or as a scientific farmer. Mr. Pflager has a farm at Sulphur Springs, Mo., on the banks of the Mississippi river, about thirty miles south of St. Louis. It is reported that his principal interest in the farm is that it gives him a new field in which to exercise his inventive mind in developing new ideas of farming.

Speeding Up Operations in

Careful Planning Necessary

The facilities and layout of engine terminals in general practice have been well established for given conditions. It is difficult to propose something new from this standpoint that would reduce the time of locomotives at engine terminals, since it is assumed that consideration has already been given to the development of the terminal in keeping with the business to be handled, and in this manner having established a satisfactory handling time at a given location.

Under present-day conditions, however, with the loss of male employees, the handling time of the power tends to increase. It is imperative, therefore, that ways and means be found to keep this time under control and reduce it, if possible. The following points are suggested:

1.—Anticipate time power will be ready for service, to the end that time in engine terminal will be reduced to a minimum.

2.—Keep a careful check at each terminal to determine any increases in the handling time; study the causes for such increases and take corrective action.

3.—Determine by a check of the Selective Service classification and the normal turnover the positions that will become vacant, and in anticipation of such vacancies inaugurate a program of instruction and training to have available the most competent employees possible.

4.—Labor saving devices and practices must be studied and their use extended.

5.—Bottlenecks can quickly form at engine terminals, particularly at points where locomotive inspection, fire cleaning, washing, coaling and sanding and taking of water are all performed on the inbound tracks. In many instances separation of these functions will reduce handling time.

6.—Install coal and ash handling facilities at strategic points for the handling of yard shifting power, so as to keep the main engine terminal operation free for the handling of road power.—*H. W. Jones, Chief of Motive Power, Pennsylvania Railroad.*

Co-operation Essential

In order to get maximum utilization from locomotives, it is necessary that the mechanical and operating department officers co-operate in a program of supervising the use that is made of the power, and the necessary maintenance attention.

All of the power possible should be operated on extended locomotive run programs of more than one engine crew district. Switch locomotives should be assigned, so far as possible, to operate three consecutive shifts, and also to operate so far as possible two consecutive shifts without being turned into the roundhouse.

Each locomotive should be assigned to a maintenance terminal and one master mechanic should be responsible for running maintenance.

Any surplus power should be at the maintenance terminal in order that repairs can be made while the locomotive is laying over. Study should be made to reduce out-of-service days for running repairs, so as to arrange roundhouse forces on the first, second and third shifts, to the end that locomotives can be turned as quickly during the second and third shifts as they are on the first shift. Work on locomotives out of service for heavy running repairs should be carried along to the maximum extent on the second and third shifts.

Out of service days for classified repairs should be reduced to a minimum, which necessitates working as many men as possible on each locomotive during the time it is out of service. In general repair shops a second shift assignment has been found to materially reduce out of service days for these locomotives.

It is imperative that necessary materials be available to make repairs to the locomotives as they become due for shop, which necessitates anticipating the needed material more in advance of the shopping of the locomotive than has been done formerly. This is due to more time being required to get delivery on material at this time than has been true in the past.—*J. M. Nicholson, Asst. to V. P., A. T. & S. F.*

Several Practical Suggestions

After the arrival of the locomotive at the engine terminal and when inspection has been completed, it can be determined how long it will take to get the engine ready. This will indicate the engines requiring the lightest repairs and they can be given preference over those requiring heavy repairs. In some instances it will not be necessary to put the locomotives in the enginehouse.

At the majority of large terminals there are peak loads and during these periods the inspection forces should be increased to prevent delays in handling. This is also true of the coal dock and ashpit forces, as well as other handling forces.

The time freight engines are held in the terminals for repairs can be reduced by giving preference to freight power requiring the lightest repairs. In the majority of cases this will be the most modern power with the greatest tractive effort. Anticipation of material needed to make repairs, and having it available at the time needed will also help to prevent delays to engines waiting for material to be manufactured or machined. Engines in the shop for form work should be worked on continuously during the 24-hour period to reduce the elapsed time required to perform this work, and should be located, if possible, nearest to the machine shop to facilitate the handling of material required for repairs.

The mechanical department in O.K.'ing power to the transportation department, should report the engine ready for service in sufficient time so that the crew will be available at the same time the engine is ready, or as nearly thereto as possible, so as to prevent any loss of time by the crew waiting for the engine.—*L. L. Robinson, Acting Gen. Supt. of Locomotive Maint., Baltimore & Ohio.*

Proper Balance Must Be Maintained

The ability of motive power to perform its intended function is vitally affected by two somewhat diametrically opposed factors, each of which has no particular bearing on the physical ability of the locomotive to do so.

The first of these factors is the time which each unit is available for the actual movement of cars, and the second is the fitness of the unit to function without delay or failure during that time. The first of these factors fathers the desirability of movement through engine terminals in a minimum time. The second factor fathers the desirability of retaining each unit in the engine terminal long enough to insure the proper performance of all necessary inspection and repair work. Experience has shown that too much emphasis on the first factor invariably produces a detrimental neglect of the second. There is, therefore, a definite need to maintain the proper balance between the two.

The maintaining of this balance is a matter meriting careful study. The first element of the study should involve the determination of what actually is the minimum average time required to consummate the necessary inspection and repair work in order to insure that when the locomotive is dispatched it will be in condition to do its required job without failure or delay.

This determination must of necessity, incorporate a consideration of the type of locomotive, the service in which it is used, federal and company requirements, availability and type of manpower; adequacy of tools, machinery and housing facilities; and the pursuance of efficient mechanical methods. By studying the maintenance and inspection requirements of a representative group of locomotives over an extended period, augmenting past experience and performance with time studies, if necessary, a minimum average efficient time requirement for repairs and inspection can be developed. The application of this yardstick to any selected terminal will satisfactorily reflect information as to what would constitute a proper time for inspec-

in Engine Terminals

tion and repairs at that particular terminal. After any changes in facilities, tools, machinery and methods found desirable have been made, this time figure, which might be called the "mechanical requirements time," can then be established.

It may then be found that the "servicing time" or that which is used between the point of arrival and time over the turntable inbound, plus the time over the turntable outbound to that of actual departure from engine terminal is too high. This fact will necessitate a second study of track layout, coaling, sanding and ash pit facilities. Here again properly conducted investigations of results obtained at the terminal under investigation, as well as at terminals known to be equipped with proper facilities and track arrangements, will point out what may be saved in locomotive hours by rearrangement of track and installation of proper efficient facilities. After all improvements which can be made in this respect are consummated, an average efficient so-called "servicing time" for the terminal can be established. The sum of the "mechanical" and "servicing" times thus established will then represent an average maximum "turning time" to which the terminal should be held.

If the studies proposed are conscientiously and accurately made, pressure on the local engine terminal management to meet the time set will produce good results without creating a tendency to slight important inspection and repair operations, which induces failures and delays enroute. Blind, unstudied demands for the reduction of turning time without regard for maintenance and inspection requirements may well drive the local supervision to the neglect of important inspection and repair needs which, in turn, will make null and void all efforts to obtain a maximum production from each unit of motive power.—*F. K. Mitchell, Asst. Gen. S. M. P. and R. S., New York Central.*

S. P. Meets Contingency

With one of the heaviest war loads to carry of any railroad in the United States, and despite receipt of 133 new steam and 77 new Diesel locomotives from 1939 to and including March, 1943, the Southern Pacific early in 1942 realized that only by maximum utilization of power would it be possible to handle the business. Study was inaugurated to reduce the time locomotives are in the hands of mechanical department. Accomplishment was by:

1.—Immediately handling the locomotive on arrival at the receiving track, where outside inspection, cleaning and checking for federal inspection and boiler wash dates were made.

2.—Prompt movement into the house for pit inspection, repairs, lubrication and service work.

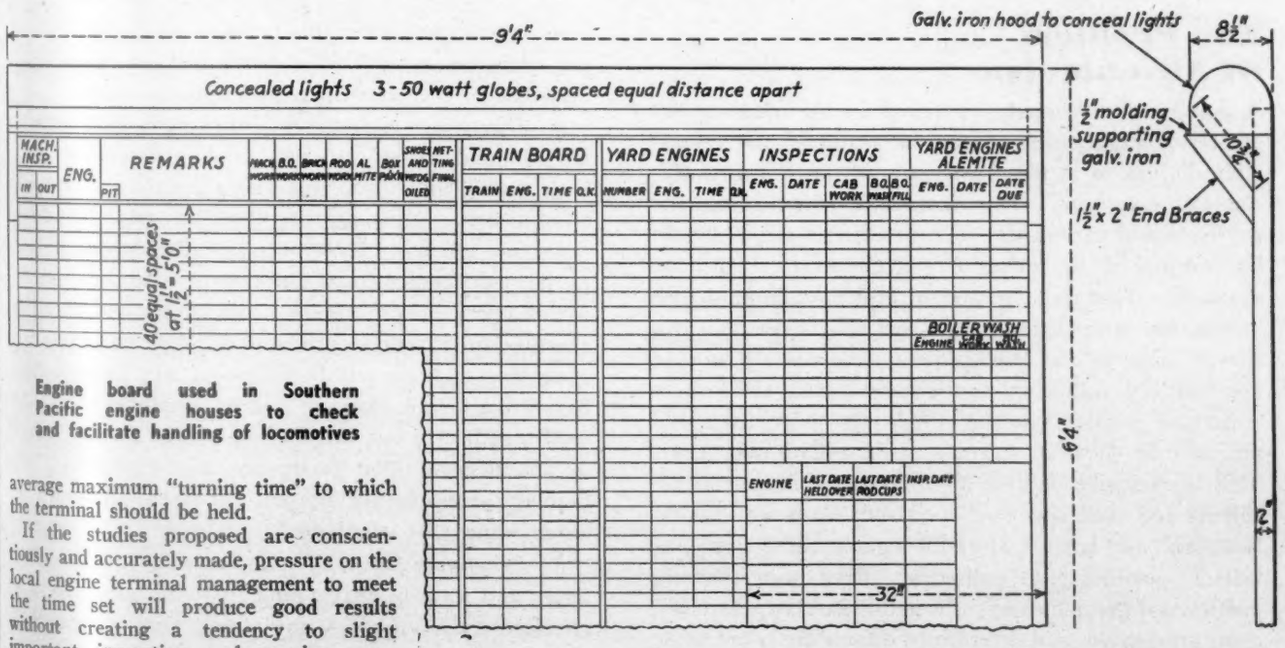
3.—Careful programming of federal inspection, boilerwash and heavy repairs, so that as nearly a minimum number of locomotives will be out of service at a time as possible; the principal repair work to be handled at monthly inspections. A conveniently located engine board is maintained, showing the engine, time called, and repairs OK'd, so that roundhouse forces can make the out-of-house times; it is shown in the illustration.

4.—Quick outbound movement from house in time to provide fuel, water, tools and supplies, to make called times.

5.—Arrangements were worked out with the operating department so that roundhouse foreman's clerk and chief dispatcher are the only two men handling power offered and called. The roundhouse clerk maintains a record of arrival time of locomotive on receiving track, time offered to dispatcher, and time called. Power is handled so that locomotives are offered sufficiently in advance of ready time to provide for a two-hour call; the enginehouse forces furnish the time to the dispatcher two hours in advance of time the engine is actually ready, so that crew is called for the time the engine will actually be released by the roundhouse for road service.

6.—Maintaining adequate forces of inspectors, hostlers, helpers, supplymen, ash pit men, and adequate supervision to insure that no time is lost in moving locomotives to and from the house. At large roundhouses, an assistant roundhouse foreman handles outside work; that is, turntable, hostling, outside inspection, fueling and placing calls. This decreases engine delays.

7.—Heavy traffic and larger power warranted many improvements, but the suddenness of the increase made it necessary that greatest use be made of existing facilities. Authority has been granted, and a great many installations have been made of additional properly-located water, fuel and sanding facilities; improved and additional track layouts have been provided to minimize congestion of inbound and outbound leads between yards and roundhouses. Longer turntables, additional and longer engine pits, have been provided, and machine tool and small tool equipment purchased.—*S. M. Houston, Asst. G. S. M. P., Southern Pacific.*



Engine board used in Southern Pacific engine houses to check and facilitate handling of locomotives

EDITORIALS

Tell Us How

A trouble maker as old as railroading itself still appears to be the primary cause of headaches for men in the car departments. In spite of all the attention which the hot box, or hot journal as some prefer to call it, has had from mechanical officers and lubricating experts, there are still too many occasions on which cars must be set out for attention or accidents occur because of hot boxes. As one car department head has recently stated, "One is one too many." *What has been done, what is being done, what can be done to eliminate all, or a major part, of the lost time, damage, unprofitable use of labor and general headaches caused by this perennial offender?* Is it design; is it the bearing; is it packing methods; is it inspection, or is it supervision that is at fault? This is a chance for you to tell your story or air your views. We want your comments for our roundtable in the June issue. Your letter must be in our New York office not later than May 14.

The Problem Of Absenteeism

A number of constructive suggestions for reducing absenteeism were developed as the result of the round-table discussion in the April issue of the *Railway Mechanical Engineer.* The manpower situation on the railroads and in industry is such that no effort should be overlooked to utilize effectively every man-hour available. That the absenteeism problem is one of first importance is indicated by the fact that according to a survey made by the Management Research Division of the National Industrial Conference Board, the loss to American industry during 1942 was more than 422 million man-days, an increase of 72 million over 1941. This is exclusive of time lost because of industrial accidents and time spent on approved leaves of absence. Industrial and labor leaders throughout the country, as well as governmental authorities, have been showing greater and greater concern over this handicap to maximum production, and determined efforts are being made throughout the nation to reduce absenteeism to a minimum.

The National Industrial Conference Board, as the result of its studies, suggests that four "fundamental methods" of bringing moral pressure upon the employees to improve attendance have been found effective. They are:

1—*The use of key employees or of employee representatives to discipline absentees.* Joint labor-management committees serve this purpose admirably by making decisions on individual cases and by carrying the decisions of the committee back into the plant.

2—*Discipline undertaken entirely by management.* British and American industrial management have both found individual interviews helpful in reducing absenteeism. Returning absentees are summoned to the personnel office, or to some other department selected by the management, and questioned as to their reasons for absence. They are then told of the serious effect absenteeism has upon production. One company calls a meeting each day of all employees who are returning to work after an absence. These employees are gathered together in one large room, where the bad effects of absenteeism upon production are explained. The number of employees present serves to illustrate the extensiveness of employee absenteeism.

3—*Premiums for good attendance.* Attendance bonuses and awards were found in some instances to be effective means of combating absenteeism in peacetime. However, wages at the present time have reached so high a level that they, themselves, are partly responsible for absenteeism.

4—*Appeals to patriotism.* Not all employees look upon war production as a second battlefront, nor do all of them respond to interpretative statistics which show the number of ships, planes and guns which are not being built as the result of time lost through absenteeism. Poster campaigns have been tried and found ef-

fective in some plants, especially when the information they contain is directly related to the company for which they are working.

Light For Welding

Nearly all electric arc welding done in railroad shops is performed under medium or low levels of general illumination against a black or at least dark background. The primary reason for this is that dark colors prevail in railroad shops. An incidental and probably accidental advantage is that the dark surroundings reflect little ultraviolet light which might be harmful to other workers in the shop. A disadvantage is the enormously high contrasts of illumination under which the welder must see his work with and without the arc.

Recent tests made in war plant welding shops indicate the desirability of using high values of general illumination. As an empirical upper limit, with respect to comfort from other considerations, the illumination for a welding area was designed for 150 foot-candles obtained from 400-watt mercury-vapor lamps in R. L. M. domes. Reflecting surfaces such as walls and columns were painted with zinc oxide base paints which absorb ultraviolet light and reflect visible light. Workers in the welding area who were not welders were given safety goggles fitted with No. 4 lenses which protect their eyes from the arcs, since they are always at least three or four times as far from the arc as the welder. These lenses also permit good vision in the shop under the general lighting. The ultraviolet-absorbing, high reflection paints reduced anxiety about ultraviolet burns from reflected radiation.

The actual welding operations have been well served by the high general illumination. As each welding rod is consumed the welder raises his hood and easy contrast conditions impose no difficult readjustment for his eyes. Individual welders have also discovered that if a white asbestos mask is set at an angle on either side of a seam, it increases the clarity with which they can see the line they are welding.

It would be ridiculous to suggest 150 foot-candles of illumination for an erecting shop or to think of painting the shop and its contents with white zinc oxide paint, but it is not difficult to do these things in small areas. Where the light sources can be placed close to the work, 150 foot-candles offers no great difficulty and where the area is small, as it is in some places assigned to the welding of small parts, a coat of zinc oxide paint does not seem impracticable. This might also be applied to the inside of welding screens. The suggestion seems to have definite possibilities, even in the railroad shop, for improving quality and speed of welding and bettering the conditions under which the welder works.

Have You A Shop Library?

It was with great pleasure and no small amount of surprise that we discovered, on a recent visit to a railway production plant a shop library of technical magazines actually intended for the use of shop personnel. It is not uncommon to find adequate libraries in the offices of mechanical department officials but it is very rare—this being the only instance of which we know—to find carefully filed but easily accessible copies of the publications devoted to shop practices and methods, among them the *Railway Mechanical Engineer*.

This library was located in a bay just off the working floor of the machine shop, readily available for foremen, workmen and apprentices, all of whom were privileged to make use of any of the publications on file. The dog-eared condition of many of the magazines gave evidence that this privilege was being used extensively. Twelve back issues are kept in the file; older copies before being discarded are examined carefully and from them are clipped all items relating to shop practice, machine setup, jigs, fixtures, tool grinding, etc., which might prove of further reference value. These clippings are assembled in scrap books where they remain available as a source of information long past the time that the magazine itself might have been expected to prove useful.

The superintendent of this shop is proud of his "library" and feels that it has done much to encourage the mechanics and others in the shop in their attempt to keep up-to-date on modern methods. Discussion of this matter with some of the men proved to our satisfaction that this superintendent was justified in his pride.

When Are We Going To Get Cars?

Late in 1942 the railroads formulated a freight-car program calling for 80,000 new cars in 1943. This was presented to WPB by ODT and before the end of the year WPB announced authorizations for the first six months of 20,000 freight cars, implying that the railroads would get half of the cars they requested for the year. Before the end of February, 1943, releases had been granted by WPB for building practically the entire 20,000 cars.

But authorizations and releases by WPB have not been enough to get cars built. Failures to secure materials have held up the program. There now remain two months of the first half of the year and only a few hundred cars have been delivered. The program for the first six months will scarcely be completed before the end of the third quarter. What is being done toward the formulation of a program for the second half of the year?

The railroads are in great need of cars. Surplus cars (about 7,000 for gondola and hopper cars and 35,000 for all freight cars) are down to dangerous levels which indicate a degree of fluidity never before attained and one which has already exceeded the margin of safety in some cases. This situation is dangerous to the future conduct of the war.

Not all of the available car-building facilities in the country are now engaged. A cooperative attitude on the part of WPB would get such facilities into production on orders to be released in the program of the second half of the year with as little delay as possible. Indeed, if action toward that end were started now, there would probably be no deliveries until early in August, assuming no unusual delays in the procurement of the necessary materials. If the entire program for the second half is to await the completion of deliveries for the first half before it can start, at least two full months of needed production time will be lost. Some of this loss could be offset were WPB to adopt a reasonable degree of flexibility in dealing with releases and allocations to the car builders. Under present methods as programs are completed men must be laid off and facilities remain idle. The reorganization of forces after layoffs—always wasteful—under the present muddled manpower situation, is becoming next to impossible.

Might not less of WPB and more of ODT in the handling of the releases and allocations of transportation equipment to the transportation agencies that are to use it, and, indeed, to the builders who are to produce it, make better use of the materials and men available for the production of transportation equipment than is now being done? ODT is a claimant agency under the CMP plan and, as such, is as much a responsible government agency as WPB. Indeed, its responsibility for the maintenance of adequate transportation service makes it equally as important in the successful prosecution of the war as is WPB. With the critical materials once allocated under the CMP plan, why should it be necessary for WPB further to concern itself with the types of cars to be ordered and with the railroads to which they are to be released

Bureaucratic red tape is not an effective instrument for winning the war.

110 Volts For Passenger Cars

"Some 110-volt cars also come into the yard, but these do not require charging." This apparently unimportant statement appears in an article in the Electrical Section of this issue under the title "Charging Sets on Rails." The article describes passenger-car battery charging facilities used in the Jacksonville Terminal Company yard at Jacksonville, Fla., and the cars referred to are those of the Norfolk & Western which came into this yard. The 32- and 64-volt cars do require battery charging, but the 110-volt cars do not.

It should not be supposed from this that the use of 110-volt car lighting and air-conditioning systems would eliminate the need for yard charging, but it does serve to emphasize again the desirability of using 110 or, at least, 64 volts. Basically, the reasons for using 110 volts on cars are as follows:

The 110-volt incandescent lamps are everywhere available and at a lower cost than 32-volt lamps.

Contactors and control apparatus are much smaller than those required for 32 volts.

Wayside a. c. power (everywhere available) can be used for lighting parked cars.

Standard commercial 110-volt equipment, such as fan motors, portable radios, grilles, mixers, toasters, milk warmers, etc., can be used.

Less copper wire and smaller conduit can be used.

The design of larger capacity axle generators is made easier, and they can be made with increased capacity or lower cut-in speeds.

Cost and size of generators and motors can be reduced.

Cost of brush and commutator maintenance is decreased on both generator and compressor driving motor.

Cost of switchboard, fuses and circuit breakers is reduced since current values are less and there need be fewer circuits.

A large number of battery cells with a small number of plates in parallel will give better performance than fewer cells with a large number of plates in parallel.

Battery cells can be more easily disposed within the permissible space requirements.

Little can now be done to improve the existing situation, but it should be given consideration. The postwar car must have what it takes to compete with other forms of passenger traffic and 110-volt systems would help. Operators are going to say, "We have been doing it with 32 volts, why shouldn't we continue?" In reply to this the car-lighting and air-conditioning engineers can offer the above list of qualifications. Some will want to know what can be done about trainlining one car to the next one in case of a power system failure. This is not done now since on air-conditioned cars this usually means two failures instead of one. The electric power system on each car should be at least as independent as that of an automobile on the highway.

The trend toward fluorescent lighting is another item favoring the higher voltage systems. No conversion apparatus is needed for fluorescent lighting with either 64- or 110-volt systems. In this way, full advantage can be taken of these high-efficiency lighting units and the cost of conversion equipment eliminated.

The cost of batteries might be increased somewhat and there would be more cells to flush, but this would be at least partly offset by improved performance and perhaps better life. Judging from the experience of the Jacksonville terminal, charging requirements would be reduced, indicating better system performance.

With the Car Foremen and Inspectors

Three Devices For the Car Shop

Three exceptionally ingenious devices designed to save labor and time in car repair work at the South Tacoma (Wash.) shops of the Northern Pacific are shown in the illustrations.

The first of these is a portable machine designed for close work under freight cars and used for reaming bolt

Portable air-operated reaming device for work in close quarters under freight cars

and rivet holes. The machine is mounted on a small compact three-wheel dolly, or truck. Just ahead of the operator's seat is a hinged steel frame which carries a horizontal bar with clevis at the outer end to support the air motor by means of two hinge pins. The rigid steel frame swings slightly in a vertical plane and the air motor is caused to move up or down by a small air cylinder (not shown in the illustration), this cylinder working against a small coil spring which returns the steel frame to its original position after each operation. The air cylinder and the air motor are both operated by suitable levers and extension rods, shown in the illustration, with air hose connections made as indicated.

The working range of this machine enables holes to be reamed either in the bottom flange of a center sill or as high as a side sill without necessitating the operator going under the car, or using blocking of any kind. As the reaming operation progresses, it is obvious that the horizontal arm gradually tips upward and the hinge connection of the air motor enables it to be kept in a vertical position by moving the machine slightly nearer the car until the hole is completely reamed.

The second device is a portable draft gear hoist, air-motor operated and used for removing and applying draft gears to freight cars. Referring to the illustration the general construction of the device will be apparent. It consists essentially of a rigid steel frame, mounted on three truck wheels and equipped with a handle for convenient movement about the shop. The top plate which supports the draft gear is pin connected to four pairs of hinged steel bars, one end of each pair being connected to the truck frame and the other carrying a flanged roller which moves horizontally on the truck frame. The two front rollers are interconnected by being mounted on the same shaft and the same is true of the two rear rollers. As the front and rear rollers are drawn together, by lever and worm-gear connections from an air motor mounted under the truck frame, it is obvious that the top plate supporting the draft gear will rise and similarly the top plate and draft gear will be lowered as the front and rear rollers separate. The usual rubber hose connection is made to the air motor which is operated by the convenient hand lever and connecting links shown in the illustration. The motor is, of course, reversible to permit either raising or lowering the draft gear.

This device is not only a great time and labor saver in removing or applying draft gears but has considerable value from a safety standpoint, also, since it eliminates the hand blocking and jacking formerly required in the restricted space under the draft gear pockets and practically avoids the necessity of car men going under the car except to guide the draft gear and coupler yoke into place and to apply the retainer plate and bolts.

The third device consists of a home-made pipe-cutting machine which is relatively simple to construct and oper-

Portable device equipped with an air-driven lift for removing and applying draft gears

ate and can be readily located at any point about the shop where a considerable amount of pipe cutting has to be done. The steel frame of this machine supports a top plate on which is mounted a pair of rollers which revolve the pipe during the cutting operation, these rollers being driven from an air motor built into the base of the machine and having an operating handle conveniently located at the front, as illustrated. The V-plate support for the outer end of the pipe is shown at the left of the machine, also the stop bar or gage used when cutting a

number of pieces of pipe to the same length. This gage is positioned longitudinally on a round supporting bar at the rear of the machine, being held in any desired position by means of a set screw.

The actual operation of cutting the pipe is performed by a single roll cutter in a horizontal cutter bar, hinge-

Simple and effective home-made pipe-cutting machine which has a capacity to cut up to 2-in. pipe

connected to a vertical post at the back of the machine, and arranged so that suitable pressure on the cutter can be developed by a hand lever at the front of the machine, as illustrated. A light coil spring is used to raise the cutter bar and cutter after each pipe cut is made. Provision for keeping the cutter well lubricated is made by means of the oil cup illustrated. The machine can be used for cutting up to 2-in. pipe, the horizontal cutter bar and cutter being raised or lowered, dependent upon the pipe size, by means of a small hand-wheel and screw built into the vertical supporting post at the back of the machine, as shown in the illustration.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

166—*Q.—How is the speed governor control for the HSC affected when the Diesel locomotive is detached?* A.—This is automatically cut out as the circuit is broken from the 64-volt locomotive battery.

167—*Q.—What takes place in the train?* A.—The contactors on the first and last cars are de-energized.

168—*Q.—What movement takes place at the F and F.S. 1864 relay valves?* A.—The magnets of the relay valves are de-energized and their valves assume the positions shown in Fig. 18. The H.S. and M.S. magnets open diaphragm cavities *P* and *N* to inshot pressure only, while application air is effective on diaphragm *64*.

169—*Q.—How does this diaphragm affect the amount of brake cylinder pressure obtained?* A.—As this is a 60 per cent diaphragm, the relay portion operates to produce this ratio of brake cylinder pressure to displacement reservoir pressure built up in cavity *K*.

170—*Q.—What does the maximum braking ratio thus produced correspond to?* A.—Standard steam road practice which permits operation of the cars in automatic service controlled by the standard ET locomotive equipment.

171—*Q.—Are there some installations in which the operation of speed governor control of maximum braking pressures is effective when the train is operated by a steam locomotive?* A.—Yes, in some installations speed governor control is retained for automatic service by shunting the contactors, which nullifies their function. Car battery supply thus remains connected for the operation of speed governor relays.

Speed Governor Control

172—*Q.—What is the basic principle of speed governor control?* A.—Referring to the wiring diagram (Fig. 14), it is the use of a generator attached to the axle of one pair of wheels of a car, the voltage of which is proportional to wheel speed, and the use of relays which operate at a generator voltage corresponding to certain speeds, which in turn cause operation of other devices, designed to provide braking force suitable for use at such speeds.

173—*Q.—What does the speed governor equipment include?* A.—A relay cabinet (Fig. 9) and an axle generator (Fig. 10) mounted on one axle, the car at each end of the train being so equipped.

174—*Q.—To what does the generator supply current?* A.—Referring to Fig. 14, generator *11* supplies current to a directional relay *1*, a directional repeater relay *5*, and the three speed governor relays *2L*, *2M* and *2H*.

175—*Q.—What is essential in regards to the current direction as it flows from the generator to the three-speed governor relay?* A.—That the current flows in the same direction regardless of the direction of travel of the vehicle.

176—*Q.—How is this provided for?* A.—The directional relay is used to detect the direction of travel of the vehicle, and its contacts position themselves accordingly in order to provide current flow in the right direction through the remaining relays.

177—*Q.—What means are provided to protect the battery against possible draining during the time the brakes are not applied?* A.—The *K-3* switch of the F.S.-1864 relay valve, located in the battery circuit, is open until a predetermined brake application pressure is developed.

178—*Q.—Describe the current flow when the car begins to move in a forward direction.* A.—Current from the generator will flow through wire *21*, upper and lower coils of relay *1*, contact *5-A* of relay *5*, test jack *72-64* and wire *22* to the other side of the generator. Relay *1* is so designed that with current flowing in the direction described, its contact will be closed in the upper position. With relay *1* so energized, current from generator will also flow through wire *21*, contact *1-A* of directional relay *1*, resistor *7*, upper coil of relay *5*, contact *1-B*, through test jack *72-64*, and wire *22*, to the other side of the generator.

179—*Q.—What prevents over-energization of the relay as the car speed increases?* A.—When the car reaches a speed of approximately 8 m. p. h. the current flowing through the upper coil of relay *5* will be sufficient to operate this relay to the energized position, opening contact *5-A*. Opening of this contact removes the generator current from relay *1*, thus reducing the load on the generator and preventing over-energization of relay *1*.

180—*Q.—Do the contacts of relay 1 remain in the position assumed during energization of the relay?* A.—Relay *1* is so constructed that its contacts will remain in the position assumed, even though the coil then becomes de-energized.

Brake-Beam Supports Missing on Tank Cars

In a circular letter recently issued by the A. A. R. Mechanical division, V. R. Hawthorne, executive vice-chairman, reports that the inspectors of the Mechanical Inspection department have found in excess of 100 recent cases of tank cars, both loaded and empty, being forwarded in road movement with brake-beam safety supports or bottom rod supports broken or missing. These supports are required as safety devices to prevent brake beams from falling to the track.

Interchange Rule 3, Sec. (b), Par. (8) requires these devices on all freight cars by January 1, 1944, to be acceptable from owners for interchange movement. Mr. Hawthorne says that every effort should be made to maintain these devices on all interchange freight cars and particularly tank cars. He urges that, before tank cars are placed for loading or after being unloaded, these devices be inspected and repaired or replaced.

Restoring Worn Truck Columns and Bolster Guides

In a circular letter, recently issued by the A. A. R. Mechanical Division, attention is called to the worn condition of truck side-frame columns and column guides on truck bolsters and the various methods used for building up or restoring these surfaces for cast-steel bolsters and truck side frames.

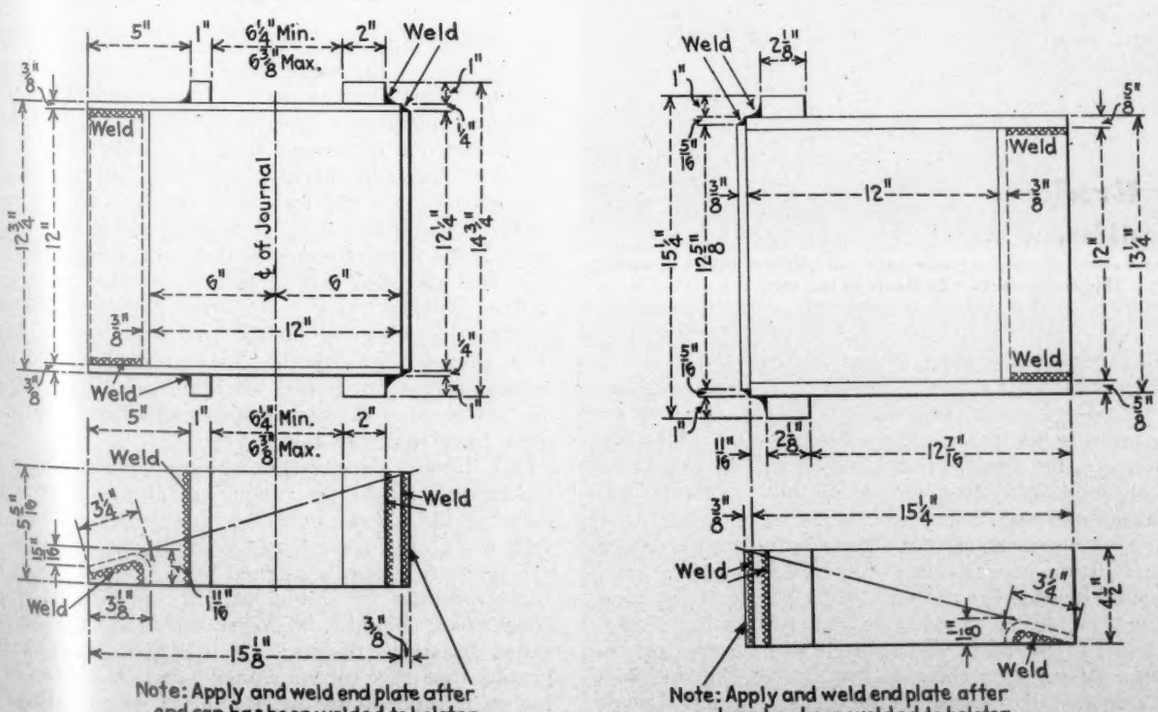
The letter explains that, under A. A. R. Interchange Rule 23, the building up of worn surfaces is permitted, providing the material remaining in the part is equal to 60 per cent of the original section. The rule also specifies that heat treatment is not required either on the cast-steel bolster or within the shaded area shown on Fig. 14 which includes the columns and column guides.

In most cases the worn surfaces on cast-steel truck bolsters and side frames can be restored by building up the surfaces by welding, and due to the frequent uneven wear this is said to be the preferable method.

In cases of extreme wear and when found impractical to restore the worn surface entirely by welding, it is recommended that the irregular surfaces be lined up and welding performed where necessary prior to the application of steel wear plates of suitable thickness, these wear plates being secured by welding.

Pressed and structural-type bolsters including the Simplex type, Bath-tub type, Huntoon and others are being gradually replaced by cast steel. The circular letter calls attention to the fact that, on most of these bolsters, column guides are provided with separate end caps made of pressed steel, malleable iron or cast steel, built-up construction being sometimes used. In most cases, it is the practice to replace these separate worn parts with new parts in preference to building these up by welding; however, where cast-steel end caps are used the surface can be restored by welding. It is permissible to replace the end caps with built-up parts of welded construction similar to the accompanying drawings which were included with the circular letter and represent two typical examples.

When worn surfaces are being restored the letter says it is important that the relation between the side frame and bolster be maintained as near as possible to the original condition without attempting to take up the entire wear on either the truck side frame or the bolster which would destroy the interchangeability of these parts.



Built-up welded end-caps for Simplex-type bolsters—50-ton car (left); 40-ton car (right)

Ladder Device for Applying Side Sheets

One of the accompanying illustrations shows the former method of applying metal side sheets to box cars by the use of a gasoline-driven tractor equipped with a swinging crane or boom which is highly flexible in operation and will lift and move any heavy car materials within its capacity at any level from the shop floor to the top of a box car. The particular operation shown consists of applying a metal side sheet to Ilinois Central box car No. 32210 which is undergoing repairs at the I. C. car shops, Centralia, Ill. The only difficulty with this job is that it ties up a crane-equipped tractor while the metal side sheet is being secured in place and, not only that, but the tractor is not always available exactly when needed owing to urgent demands for this valuable ma-

Former method of using a crane truck and platform ladder in applying metal side sheets to box cars

terial-lifting and moving device at many other points throughout the car shops. The result is that the time of at least one car man and helper is more or less wasted while waiting for the crane truck.

To avoid this loss of time, a simple welded steel ladder with an angle iron cross bar at the top, to which a chain and hand-operated jack connection can be made to the metal side sheet, is used for easily raising or lowering the sheet to the exact position required for riveting. This particular device was the idea of an Illinois Central car man welder, A. L. Foutch at Centralia, who received $25 and an Award of Individual Production Merit for his suggestion. According to the Illinois Central Magazine, which first described the device in its January, 1943, issue, the idea has also been referred to the War Production Board in Washington with recommendations for higher award and extension of the plan to other roads.

Referring to the second illustration, it will be noticed that the ladder itself is constructed of light angle side

Ladder and hoist device which permits applying side sheets without waiting for a crane truck

pieces and cross bars, fabricated by welding. The chain connection to the metal side sheet is made by means of a steel strip bolted to the lower part of the sheet at one end and engaging a hook on the chain at the other. The hand jack (in this case a Coffing hoist) can then be used to give fine adjustments in position of the side sheet required for the application of fitting-bolts, reaming the bolt holes and riveting. A further advantage of this device is the small amount of floor space required and the fact that the sheet can be held in position as long as required without tying up a crane-equipped tractor. In addition to speeding up the particular job of renewing side sheets, releasing the crane truck has also had the effect of expediting shop work and releasing freight cars for service in a shorter period of time than would otherwise have been possible.

Mr. Foutch's suggestion was: "I suggest that a ladder device be adopted for raising metal side sheets on box cars for the following reason: It can be operated by two men more effectively than by the 'mule,' inasmuch as it can be more properly aligned by a slight pressure of the hand, whereas the 'mule' with its mechanical power in some cases, should it be obstructed in any manner, might cause disastrous results." It is evident from the photographs that this recommended practice, simple as it is, has in it time saving merit. More of such suggestions would be useful in all railroad shops and might possibly help in overcoming other simple problems of production.

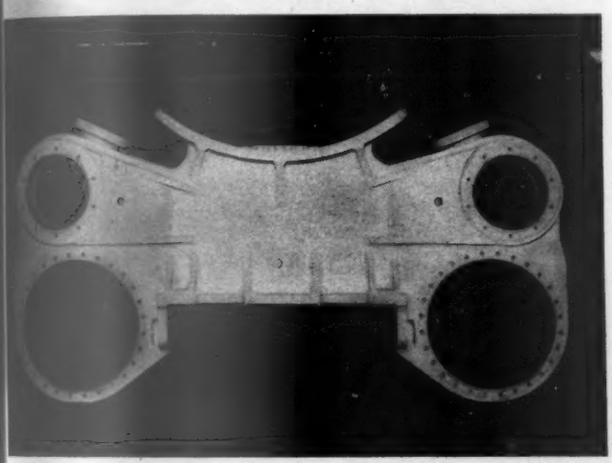
IN THE BACK SHOP AND ENGINEHOUSE

Welding Locomotive Cylinders*

By Carl Ray Averitt

In building one-piece welded locomotive cylinders three important factors must be considered, namely, maximum utility, convenience and economy. This required much thought and careful study by the design men but resulted in simplification and reduction in the amount of welding required. The material chosen was a mild steel of low carbon content which had excellent weldability. Proper electrodes were specified and qualified operators selected.

One hundred and twenty-nine parts were needed. They were cut to shape and scarfed for welding by the oxy-acetylene process on a machine designed for such work. When the plate material was cut it was sent to the blacksmith shop for all bending required. This work was done in a large hydraulic sectional flange press after the material had been pre-heated in an oil furnace.



Completed cylinder which required 3,083 man-hours of labor

Welders were chosen from among trained men, who, are tested periodically for ability and workmanship. These men are coached and taught the use of proper electrodes, as to size, type and analysis. Proper technique in the selection of the type of joint, current control, positioning, pre-heating (when necessary) and heat treatment of finished work is taught.

Welding Procedure

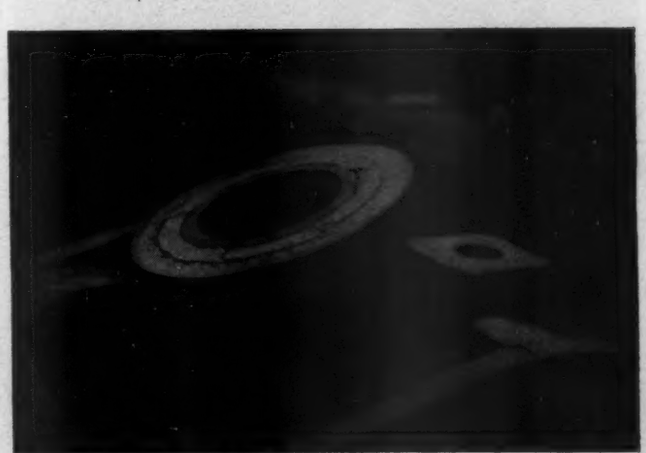
After two welders for each of the three working shifts had been selected to fabricate the cylinders, the various parts were then set up and made ready for welding. Some parts such as the steam chests and cylinders required fabrication themselves before the complete cylinder could be set up. Welding had to be completed on the inner surfaces before the final pieces could be applied.

The contraction due to heat set up by the weld metal had to be allowed for in setting up all parts. One-quarter inch was allowed in the length and 1/8 in. in the width and these allowances proved to be very accurate. The parts were held in place by spacers and bracing bars to withstand strains of contraction and pulling and to

Cost Production Figures for One-Piece, All-Welded Cylinder for Passenger Locomotive

Labor	Man-Hours	Cost
Blacksmith	338.50	$ 257.24
Welding	1,559.06	1,402.18
Machine	1,176.01	795.39
Other	9.30	8.04
Shop expense	....	763.51
Total	3,083.27	$3,226.46

Material Welding Rod, in.	No. of Rods	Weight, lb.	Cost
3/16	6,777	1,093.0	$69.73
1/4	3,604	1,001.1	57.56
5/32	3,366	336.6	31.03
Total	13,747	2,430.7	$148.32
Steel used (including two cylinder heads)	....	....	$762.91
Oxygen used for cutting	....	....	16.65
Miscellaneous	....	....	13.19
Total, all material	....	....	$941.07
Total cost, labor and material	....	....	$4,167.53
Total cost of cast-steel cylinder	....	....	$5,137.55
Total savings	....	....	$ 983.21
Total weight of fabricated cylinder (includes bushings and cylinder heads), lb.	15,352	....	....



Details of welding shown before sand blasting

* Abstract of a prize-winning paper submitted in the recent $200,000 Industrial Progress Award Program of the James F. Lincoln Arc Welding Foundation.

insure proper alignment. Care was taken in the welding to keep procedures uniform.

Finishing Operations

After welding had been completed the cylinder was placed in an oil-heated furnace and raised to a temperature of 1,550 deg. F. to relieve stresses and produce a uniform grain structure in the steel. After having been normalized the piece was sand blasted and sent to the shop for machining. This included the machining for bushing applications, finishing the steam chest, machining the smoke-box saddle, drilling and tapping for the cylinder bead studs and machining of the cylinder-head seats.

Cost figures for materials and the various labor costs are shown in the accompanying table.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Cracked Valve Spools Repaired by Welding

Q.—What method do you suggest for reclamation of cracked valve spools?

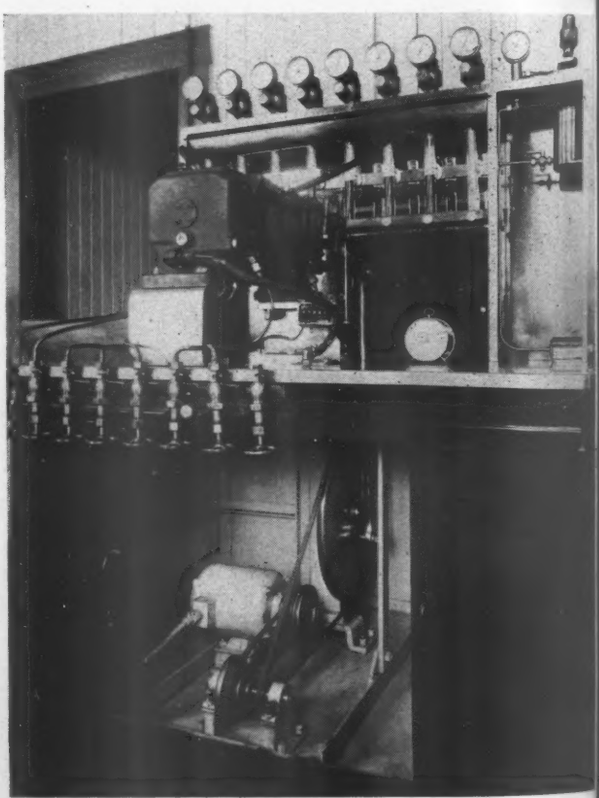
A.—A simple method of repairing cracked valve spools is to melt out the fracture, preheat with a large welding head to a dull red and weld with cast-iron rod. However, it is a simple matter to make a new spool out of scrap superheater flue and small pieces of plate, welding the parts together. These all-welded steel spools give no trouble and because of the smooth surface do not seem to gather carbon as rapidly as the cast-iron type.

If the required diameter of the straight center section is too large to use superheater flue, roll up a piece of 3/16-in. plate and weld the seam. The flared ends are made from 3/16-in. or 1/4-in. plate and are bent similar to the cast one they are to replace. Two discs of 3/4-in. plate are flame cut large enough to machine to the correct diameter of the spool and these are welded securely to the flared sections. When this assembly is complete the ends are machined to the same dimensions as their cast counterparts and a long wearing, good looking valve spool is the result.

Fabricating valve spools by welding

Test Rack for Mechanical Lubricators

The mechanical lubricator test rack, illustrated, is used at the St. Louis-San Francisco locomotive shops, Springfield, Mo., to indicate the pressure on the terminal



Lubricator test rack used at the Springfield, Mo., locomotive shops of the St. Louis-San Francisco

checks and the necessary adjustment of the various feeds with a predetermined count and stroke at a temperature of 140 deg. to 150 deg. F.

The rack is equipped with nine terminal checks, each located above a measuring cylinder of four liquid ounces capacity, graduated in drams (1/16 of a fluid ounce). A drip pan of sliding construction is located above the measuring cylinders which can be brought forward above the cylinders to prevent further flow of oil to the cylinders when necessary during a test. A reduction counter registers the count which represents a revolution of the driving wheel.

The illustration shows the electric drive arrangement and indicates how the eccentric may be adjusted to the required stroke, the same as that obtained from the

lubricator drive on the locomotive with the valve gear set at the prescribed cut off. The lubricator feeds are connected to the terminal checks with ⅜-in. O. D. copper tubing having a ⅜-in. angle valve permanently located on the rack.

A steam heat line is connected to the lubricator to provide the required temperature of the oil, using a laboratory thermometer. The motor is equipped with a rheostat control which may be adjusted for the desired speed.

Having the count, length of stroke, and the feeds to the cylinders, valves and pumps given, it remains to adjust the feeds, with the arm on the eccentric set for the desired stroke.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Mud Rings Repaired by Welding

Q.—Is it necessary to remove the mud ring from the boiler when repairing a cracked or broken mud ring? What is the recommended procedure for making such repairs?—W. I. R.

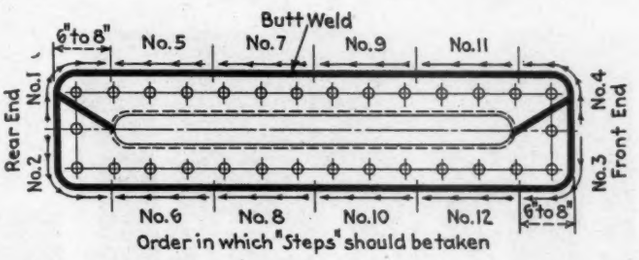
A.—Cracked or broken mud rings can be repaired by either electric or oxyacetylene welding without removing the mud ring from the boiler. A portion of the firebox side sheet at the point of the crack is cut away, exposing the mud ring for a sufficient distance so that the mud ring can be veed out at the point of the crack or break. The mud ring should be veed out from the top, the vee extending the entire width and depth of the mud ring. Weld metal is then deposited in the vee. Care must be taken to insure proper fusion between the deposited weld metal and the mud ring. Continue until the vee is filled with weld metal and reinforce the weld on the top.

After the repairs to the mud ring have been completed, a suitable butt-welded patch is applied to the side sheet where the section was cut away. All firebox ring rivets removed are reapplied to complete the repair. Where the mud ring is removed from the boiler, the same procedure of welding cracked or broken mud rings is followed except that the mud ring is veed out from both the top and bottom of the crack and the top and bottom vees are welded up at the same time by two welders.

Welding Thermic Syphons

Q.—What is the best method of welding Thermic syphons to the crown sheet of a locomotive boiler?—J. T.

A.—Any method of welding syphons to the crown sheet that will properly provide for expansion and prevent creeping as the welding progresses is satisfactory. The step-back method is suggested, and can be used with either the electric or oxyacetylene process. Plates should be properly clamped and braced to prevent undue movement and distortion. The ends should then be welded; beginning at No. 1 on the diagram, coming around the corner from 6 in. to 8 in. Follow with No. 2, then 3 and 4 at the front end, then back to 5, etc.,



going an equal distance on either seam to distribute the stress. The length of steps depends on the rigidity of the sheets. Where radial staybolts have been applied in the crown sheet, the steps should be from 12 in. to 14 in. long; where radials have not been applied, the steps may be longer.

Reinforcement Of Reverse Gear Bracket

Q.—A reverse-gear bracket is to be applied to the side of a boiler with five 1-in. studs. The studs are staggered, with two studs in the top row and three studs in the bottom row. They are spaced 7 in. apart and the distance between the two rows of studs is 2½ in. Should the shell course be reinforced behind the reverse-gear bracket due to the application of these studs?—F. E. C.

A.—The shell course should only be reinforced if the efficiency of the shell plate through the stud holes falls below the efficiency of the shell course to which the bracket is attached. The efficiency through the stud holes is the relation of the strength of the shell between the stud holes as compared to the strength of the solid plate for the same distance.

For the conditions outlined in the question, the total distance over the studs can be considered to be 4×7, or 28 in.

The diagonal distance between any two studs would be

$$\sqrt{(7)^2 + (2.5)^2} \text{ or } 7.4 \text{ in.}$$

The solid plate between any two studs would be the diagonal distance between the studs minus the diameter of the studs or

$$7.4 - 1 = 6.4 \text{ in. of solid plate between stud holes}$$

The total amount of solid plate between the two end studs would be

$$6.4 \times 4 \text{ or } 25.6 \text{ in.}$$

The distance between the two end studs is 28 in.

The efficiency of the shell between the two end studs would then be

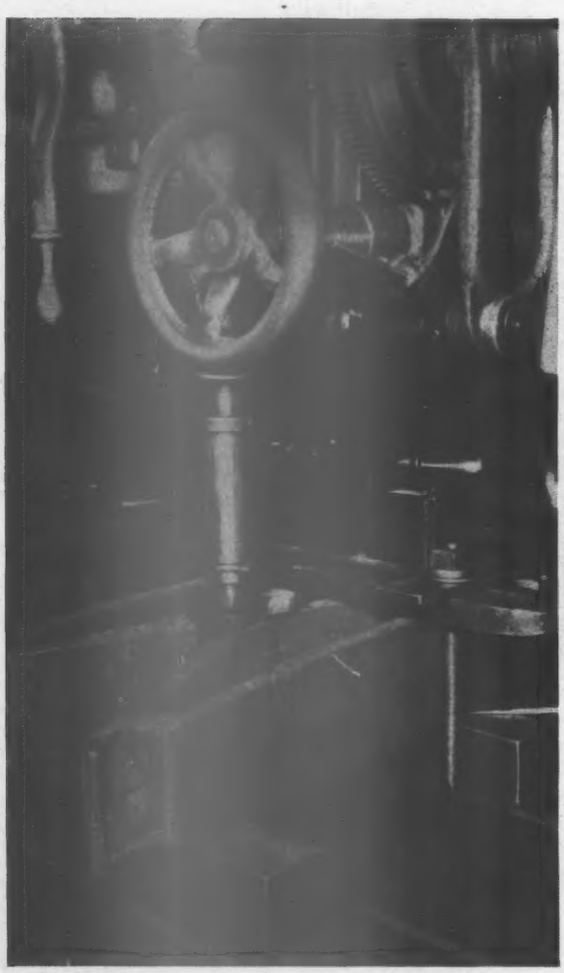
$$\frac{25.6}{28} \text{ or } 91.4 \text{ per cent}$$

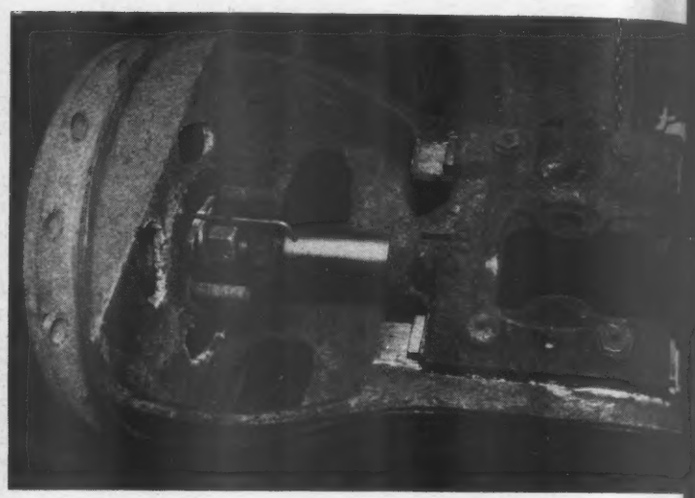
The thickness and the tensile strength of the plate being the same for both conditions, same can be cancelled out.

Should the efficiency of the course to which the bracket is applied be greater than 91.4 per cent, the shell course would have to be reinforced.

Time Savers on the Santa Fe

Six jigs in use at the Topeka locomotive shop

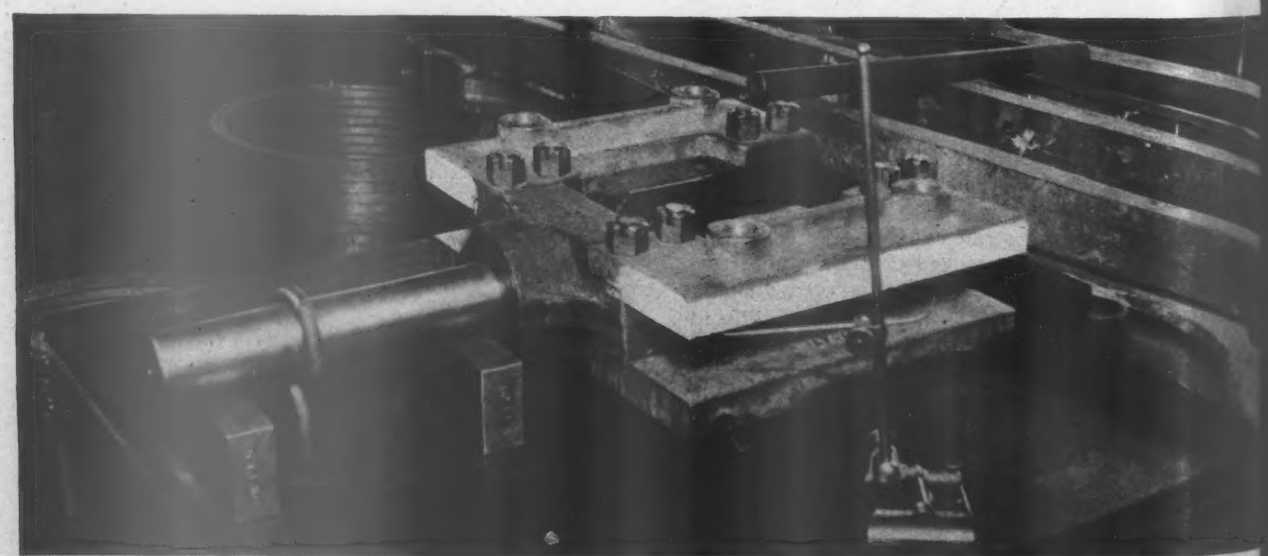




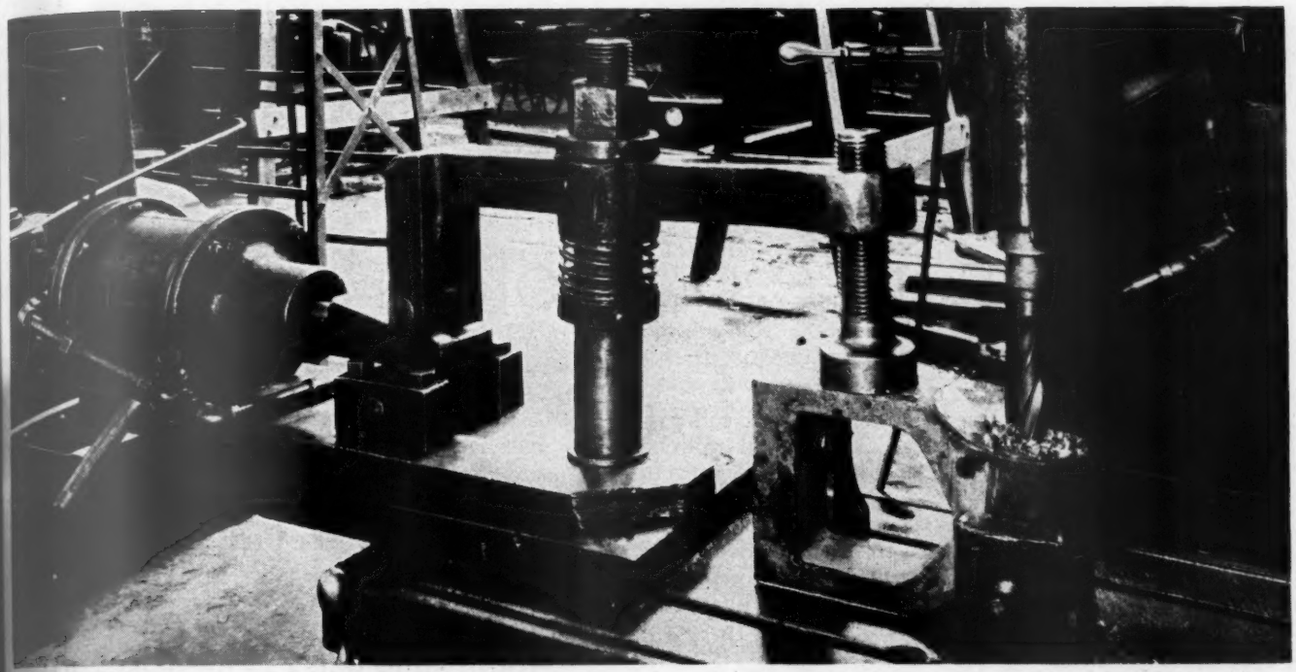
Above: A jig for lining valve-stem crossheads—The valve-stem crosshead is fitted with a stub valve stem which carries a fishtail tram—By revolving the stub valve stem in the crosshead it is possible to line the crosshead central with the stuffing box—Time saved, 18 min. per crosshead—An angle bracket supports the valve-chamber heads on the bench

◆

Left: A jig for boring tender-truck equalizers when machining the equalizer seats and the spring shackle seats in pairs, either new or after building up by electric welding—Time saved, 10 hrs. per locomotive set



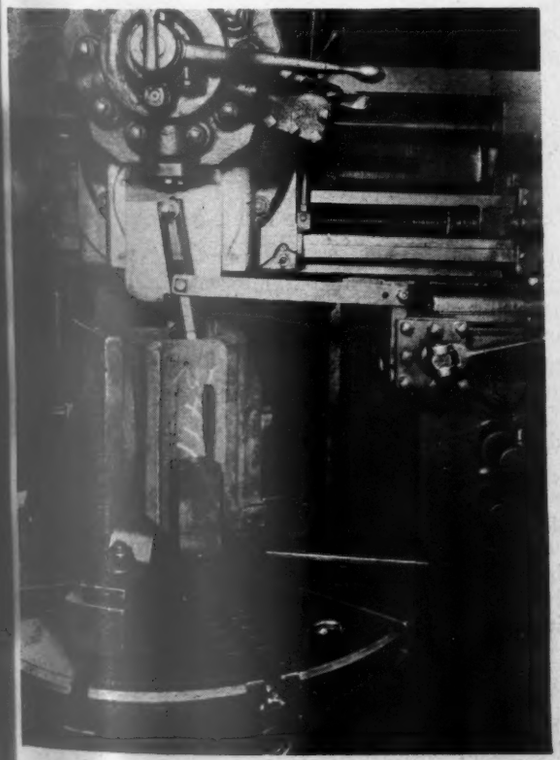
A jig for laying out valve-stem crosshead liners—It consists of a face plate, 30 in. by 30 in., mounted at work-bench height; two parallel blocks 1½ in. by 2¾ in.; a J-bolt, and a stub valve stem of suitable length—The liners are bolted in place on the crosshead and the valve stem driven in and secured on the parallel blocks by the J-bolt—With a surface gauge the edges of all four liners may be laid off at one setting—Time saved, 24 min. per crosshead

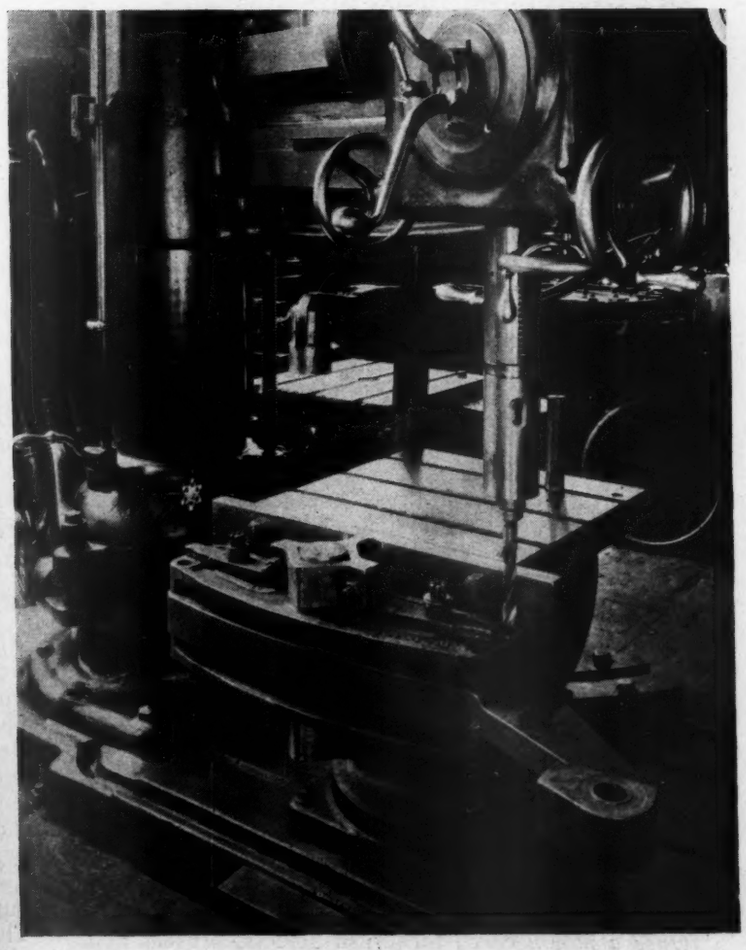


Above: An air clamp for a vertical drill press—It is used for holding special work, including spring-rigging parts, on a drill-press table—The level type clamp and adjustable holding screw are actuated by a suitably mounted air-cylinder and taper steel wedge applied to the end of the piston rod—Average time saved, 1½ hrs. a day

◆

Below: Jig for turning ball seats for equalizer-bearing pads in the top of Batz-Lanning engine-truck boxes—It consists of a suitable bracket for supporting the box on the boring-mill table, a hinged tool post and cutting tool, and lever connection to the side tool head of the machine—Time saved, ½ hr. per box





Above: A jig for drilling and reaming the bolt holes through Walschaert valve-motion links and link plates—The jig consists of a base and two V-blocks—The base, which is vertical, is bolted to the side of the drill-press table—The V-blocks, which are parallel and in line, are welded on the base—These receive the trunnion bearings which are held in place by clamps bolted to the V-blocks—The link and trunnion plates are held together with two bolts and clamps—Time saved, 36 min.

ELECTRICAL SECTION . .

Preventive

Maintenance of Motors

By J. T. Pringle*

and

W. W. McCullough†

Motor stockpile can be sustained and work interruptions avoided if a few simple rules are observed

ALTHOUGH they do not actually move freight and passengers over the rails, the electric motors in railroad shops and terminals properly maintained will prevent delays to train movements.

The failure of a turntable tractor motor could cause an appreciable delay in moving a fresh locomotive to the ready track. A pumping plant, coaling or compressor station must have its motors in working order or serious train delays will result. Railroad facilities are being worked harder than ever before, therefore every precaution must be taken to prevent motor failures. That is where *preventive* maintenance pays dividends.

The ideal motor maintenance program aims at prevention of breakdowns rather than their repair. Maintenance involves competent, periodic and systematic inspection. A thorough survey of each motor installation should be made and a systematic inspection and maintenance schedule established and enforced.

Records must be kept consistently on the schedule selected. Several excellent record systems have been developed and reduced to printed form, so that it is not necessary to go to the trouble and expense of devising individual systems.

Prevention of breakdowns may be helped by a thorough analysis of the equipment involved. For example, if the difficulty is the frequent tripping of overload relays, it may be the installation of a different type of relay with thermoguards on the motor will enable the motor to carry the loads without an injurious temperature rise. Complete replacement of certain obsolete units may be called for, or it may be that in a blacksmith shop replacement of one large blower by individual blowers is required. Possibly, the addition of one or more jib cranes in a shop would relieve overloaded crane facilities.

Maintenance Schedules Should Include Systematic Inspection

It is impossible to give any hard and fast rules for frequency of inspection. The following suggestions are based on average conditions.

Once a week check oil level in the bearings and see that the oil rings are moving freely. Check the temperature of the motor bearings and primary iron with the hand. Sniff the warm air coming from open motors. The fumes emanating from overheated insulation are unmistakable.

Once a month check the brush holders, brushes and shunts. Blow out the motor with compressed air. This may have to be done more often in roundhouses, on coal, sand and ash handling equipment where there is excessive fine dirt.

Once a year check air gap with feeler gauge. Check insulation resistance with a Megger. Check line voltage with a voltmeter, and load with an ammeter. Equip critical motors for socket type ammeters so that load can be readily checked. Clean out and replace grease in ball and roller bearings. Check renewal parts stock in light of the past years' experience and order replacements from the motor manufacturer.

Every two years dismantle the motor. See that all windings are tight. Replace loose wedges and loose bands before dipping in varnish and baking. Inspect commutators and commutator connections. Sleeve bearings require no flushing. At intervals of about 2 years in average service, or during general overhaul periods, remove the bracket and wash out the bearing housing. Use hot kerosene oil and compressed air if available.

Faulty Bearings Cause Most Motor Failures

All motors depend upon a mechanical assembly of some sort for the transformation of electrical energy into mechanical energy or work. The bearings are a very important link in this mechanical assembly.

Bearings probably cause more shutdowns, delay and expense, than any other cause. This is not surprising, when it is remembered that they are victims of poor foundations, misalignment, vibration, thrust from couplings, dirt under and over lubrication, and frequently the wrong lubricant; all this in addition to their real job of supporting a rapidly revolving part.

The first requirement of successful bearing operation is lubrication. This entails more than just an adequate supply of lubricant; the lubricant, the bearing design, and its condition, must be correct.

Proper Lubrication Dissipates Heat in Bearing

Sleeve bearings sustain the essential oil film to prevent metal-to-metal contact between the shaft and the bearing

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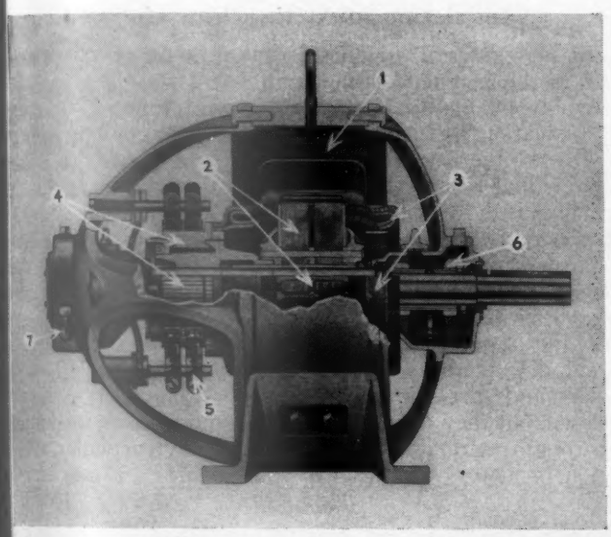
† Maintenance engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

surface. Properly designed bearings have adequate area for the load, proper oil grooving, working oil rings, and suitable materials.

Safe operating temperature for bearings under normal operating conditions is considered to be 40 deg. C. rise above the surrounding room air. At this temperature a bearing feels only comfortably warm to the hand. Assuming proper mechanical condition of the bearing, whether sleeve or ball, and the bearing assembly, and assuming that proper lubricants are used, temperatures elevated above 40 deg. C. call for immediate investigation.

Oil Film Lubricates Sleeve Bearings

In a sleeve bearing the oil sticks to the shaft and is dragged along by the rotation of the shaft so as to form a wedge-shaped film between the shaft and the bearing. This film of oil carries the load, and prevents metal-to-metal contact. So long as this film is established and



Cutaway view of a d.c. motor—1, field coils; 2, armature; 3, armature coils. 4, commutator; 5, brush rigging; 6, sleeve bearing; 7, oil overflow and filler plug

maintained there is no metal-to-metal contact in the bearing while the shaft is rotating, and, therefore, no perceptible bearing wear.

Two outstanding considerations govern the maintenance of sleeve bearings. First, is to insure the existence of the oil film once rotation has begun. *Use the right oil.* The second is to minimize the destructive effects of metal-to-metal contact when the film is lost, either by accident, or during the starting period. *Use the right babbitt.*

For sleeve bearings, proper maintenance keeps the oil well filled to the proper level and the oil rings turning freely. New oil should be added only when the motor is at rest to prevent overfilling of the reservoir. Oiling of bearings is more often overdone than underdone. Sleeve bearings which require frequent refilling and thereby leak oil onto the stator windings should be replaced with sealed sleeve-type brackets and bearings.

Oil rings generally carry far more oil than is necessary for proper lubrication of the bearing. When running, most of this oil is carried on the outside diameter of the rings by centrifugal force. This excess oil causes splashing and spray inside of the bearing housing. Air currents that pass through the housing pick up this spray and deposit it on motor windings. Sealing the bearing against the entry of air currents is therefore necessary and is accomplished in all modern designs by close tolerances, felt seals, and air by-passes to offset blower action of rotating parts.

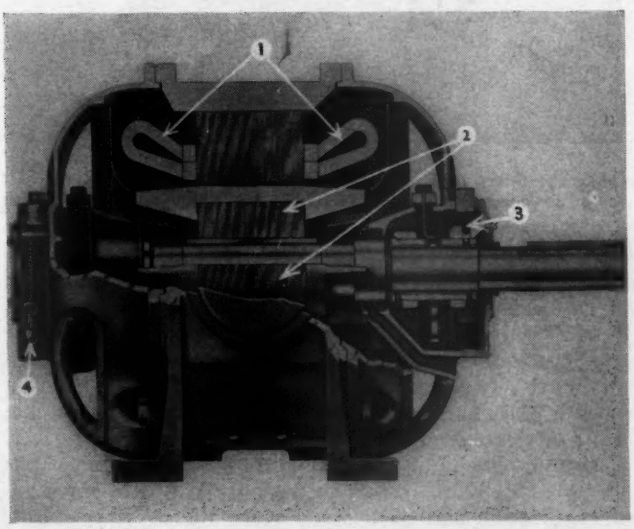
The purpose of the felt washer in these seals is often misunderstood. The real purpose of the felt is to keep out air and dirt. In itself it has little value for preventing leakage of oil once it becomes oil soaked. Bearing wear, which means radial movement of the shaft, spoils the effectiveness of the bearing seals. Replace all felt seals at the same time when replacing sleeve bearings. These felt seals should be ordered from the manufacturer of the motor. If it is necessary to make them in an emergency, use high-grade felt not less than ¼ in. thick before compression. Make the inside diameter of the washer the same as the shaft or slightly less. Cut the felt true with edges at right angles to the surface of the felt.

Oil leakage is generally aggravated by high temperatures. Keep bearings cool and use an oil that does not foam easily.

Clicking Sound May Indicate Ball Bearing Trouble

Ball bearings have become increasingly important with the use of totally inclosed and fan-cooled motors. In a sleeve bearing, as just explained, the shaft when in motion is separated from the bearing by the oil film. In a ball bearing, a series of steel balls act as the separating medium, both when the motor is stationary and when it is running.

To keep the steel balls uniformly distributed around the bearing a cage or retainer is used, each ball having its own pocket. The balls have rolling contact with the raceway, the sliding contact with the surfaces of the retainer. This means that lubrication is necessary.



Cutaway view of an a.c. squirrel cage motor—1, stator coils; 2, squirrel cage rotor; 3, sleeve bearings; 4, oil overflow and filler plug

Most ball bearings used in horizontal motors are grease-lubricated although some supplied with vertical motors use oil. Follow the advice of the motor manufacturer in selecting a suitable grease. Carelessness in allowing containers to remain open causes trouble from abrasive dirt. Soda-base soap greases are usually preferred on account of their high melting point and their stability. They mix readily with water, however, and tend to form an emulsion.

Ball bearings in distress can usually be detected by undue heating or by unusual noise. Broken or nicked balls cause rapid destruction of the bearing. They can be detected by the clicks.

If the conventional 40 deg. C. rise above the surrounding air is exceeded, look for an overfilled bearing, since the first result of over-greasing is heating caused by churning of the grease. The general rule is that the housing should not be over half full. Clean the old grease from the bearing and from the housing once a year and replace it with new grease. Average service is assumed.

Oiling the motor regularly is essential to the long bearing and shaft life—Too much oil may contaminate the motor windings, causing possible deterioration of the insulation

After the machine is dismantled, the bearing should be carefully wrapped in clean cloth or paper to protect it from outside dirt. Remove all old grease from the housing and clean the housing and bearing either in Stoddard solvent or in carbon tetrachloride. This is a difficult operation because particles of grit are not soluble and are removed with difficulty. Remove final residue of cleaning medium with a light oil before filling with new grease. The container with fresh grease must be carefully protected from dirt. Keep the cover on tight. Use a clean, nonmetallic paddle for applying the fresh grease.

Check Air Gap With Four Readings

The air gap in a motor is dependent first on proper maintenance of the bearings and second on the proper alignment of the brackets or pedestals with the frame. Alternating-current motors operate with less gap than direct-current motors, and are therefore more critical. Check the air gap with a feeler gage at the established schedule period. Make these checks at the pulley end, taking 4 readings on each motor, 90 deg. apart. For motors below 10 hp., a minimum gap of .005 in. should be maintained. Above 10 hp. the minimum gap shou be .010 in.

Couplings Require Parallel Alignment

Where coupled type motors are used, the coupling require regular inspection. Faulty alignment in a soli coupling is reflected in bearing trouble and vibration Make sure that all dowel pins are in correct position an check the faces of the couplings with a feeler gage afte the bolts have been removed. Shift the motor positio to make the faces of the two half couplings parallel.

Flexible couplings will operate under more severe misalignment without causing trouble; however, the tw halves should be checked with a steel scale to make sur they are in alignment. Any misalignment means in creased wear on the pins, fingers, and leather disc whichever may be used. Special type flexible coupling should be checked according to the manufacturer's in structions.

Insulation Must Be Clean and Dry

The electrical conductors in a motor are separate from the magnetic circuit and from the mechanical as sembly by materials generally grouped under the ter "Insulation." Insulation is also used in commutators t separate the bars from each other and in coils to isola individual turns. It is important that the insulation b maintained so as to function as a separator between th copper in the motor and the mechanical assembly. Re gardless of the class of insulation used, remember tha electrical insulation materials are non-conductors onl when clean and dry.

The importance of keeping electrical equipment clea and dry is always worth stressing. Accumulations o dust and dirt not only contribute to insulation break down, but they operate to increase the motor temperatur through restrictions of ventilation. Pay particular atten tion to motors operating in roundhouses and blacksmith

Turntable motors, upon which much depends, are required to operat out-of-doors under rough service conditions and should therefo receive frequent inspection

shops. Dust and dirt is effectively removed with com pressed air at about 50 lb. pressure. Do not direct com pressed air against the insulation until it is free from moisture that may have accumulated in the air line from condensation. Too great an air pressure may loosen the binding tape or injure the insulation by sand blasting

with the abrasive dirt which is nearly always present. It may not be possible to remove all dust and dirt by blowing with compressed air. If the accumulation of dirt contains oil or grease, a solvent will usually be required to remove it.

There are three types of solvents in general use for this purpose. These are petroleum distillates, such as Stoddard Solvent or cleaners' naphtha, carbon tetrachloride, and a mixture of the two. The petroleum distillates are the solvents having the least corrosive action on insulation varnishes, and for that reason where conditions permit are preferable to the others. The Stoddard type solvent, produced by all the major oil companies, with a minimum flash point of 100 deg. F., minimizes the fire hazard, and should be used in preference to gasoline or benzene. Every precaution should be taken however, to prevent fires or explosions.

When this type of solvent will not properly clean the apparatus a mixture of carbon tetrachloride and the solvent may be used. A mixture of 50 per cent carbon tetrachloride and 50 per cent Stoddard Solvent is nonflammable, but the vapors mixed with a right proportion of air are explosive. In extreme cases it may be necessary to use straight carbon tetrachloride; however, its toxic effect on the operator must be taken into consideration.

Carbon tetrachloride is more corrosive in its action than petroleum solvents, and it evaporates much more rapidly. For this reason the residue of carbon tetrachloride should be removed by applying a petroleum solvent. This will prevent corrosion later on.

Before any solvent is used, be sure that there is good ventilation and minimum fire risk. Do not let the workers' clothing become saturated with the solvent. Always have fire extinguishers of the carbon tetrachloride type handy. If a hose is used to spray either cleaning solution or varnish, make sure that the nozzle is grounded.

To keep a motor clean, use a suction hose or an air line—Although a metal cover (removed) gives some protection to this motor installed on a carpenter's saw, sawdust will get to the windings

Workmen should be guarded against breathing the fumes of carbon tetrachloride and they should be under the close observation of someone familiar with artificial respiration. Where conditions are particularly bad, such as in pits, gas masks should be worn.

The time to apply varnish treatment is after the motor has been thoroughly cleaned in solvent. Use a baking varnish recommended by the motor manufacturer for the particular conditions encountered. Two dips and bakes may be sufficient for normal conditions, while for extreme conditions of moisture and corrosive gases such as exist in roundhouses four dips and bakes may be justified. One or two additional coats of red synthetic enamel may be justified under extreme conditions.

Dry the motor in an oven before dipping in varnish. Electric or steam heat is the safest and most convenient.

To assure proper maintenance and prevent sparking, it is necessary to undercut the mica below the surface of the faster wearing copper commutator bars on a d.c. motor—This tool undercuts the mica to 1/16 in. below the commutator surface

Make sure that suitable temperature control is provided and that it is effective so as to prevent injury to the insulation. Maximum dry-out temperature is 155 deg. C. Baking temperature for the varnish and length of the baking period will depend on the type of varnish which is used.

Insulation Testing Determines Comparative Conditions

Insulation tests are made to determine the condition of the insulation rather than the quality of the insulation. While special conditions may justify dielectric tests, over potential tests, high frequency tests, or dielectric power factor tests, a test to determine the insulation resistance is generally all that is required in maintenance work.

The most convenient way to read insulation resistance is with a Megger. The 500-volt type is generally used. A higher-voltage Megger may damage low voltage insulation. Remember that the readings are valuable only from a comparative standpoint and that they vary greatly with the temperature of the apparatus. A safe general rule is that the insulation resistance should be approximately one megohm for each 1,000 volts of operating voltage, with one megohm as a minimum.

Totally Enclosed Motors Protected from Outside Air

Totally enclosed motors and totally enclosed fan-cooled motors have the frames sealed so as to exclude the outside air. They are well protected against the admission of abrasive dirt and metallic particles that shorten the life of insulation in open motors. For these enclosed motors there are two points which should be observed.

First, see that all exposed joints in the motor frame and brackets are tight. Use a water-resistant grease in the bracket fits, if the motor is dismantled for any reason. This will help to prevent accumulation of water in the bottom of the motor frame.

Second, make sure that the motor is provided with a drain plug or drain pipe at the bottom of the frame so that any accumulated water can be removed before causing trouble.

Careful Handling Required for Direct-Current Motor Repair

Direct-current motors add the commutator and its current-collecting details to the general maintenance problem. The armature is the heart of the direct-current motor. Through it flows the main-line current, and if the machine is overloaded the armature is the first to give evidence of distress.

When dismantling a d.c. motor for periodic overhauling the following points should be observed. Do not roll

A thorough maintenance program does not neglect brushes—Proper method of cleaning and surfacing is to press brush down on a strip of sandpaper placed between brush and commutator—Several passes should be sufficient, depending on brush condition—The sandpaper should be held flat against the commutator surface to prevent rounding of the brush end

the armature on the floor; a coil may be injured or the steel banding wire may be nicked. Support or lift the armature only by its shaft if possible. Never allow the weight of the armature to rest on the commutator or on the coils. Inspect the coils carefully to see that they are tight and where necessary replace the wedges. Replace any bands that may be loose.

As far as possible duplicate the banding originally furnished by the manufacturer. Do not change the material in the banding wire, the diameter of the banding wire, or the width or position of the band. Increasing the band width may cause heavy currents in the bands sufficient to overheat and melt the solder.

Only experienced workmen should tighten loose commutators. If the commutator bars are tight they will give out a clear bell-like ring when tapped lightly with a small hammer. If the commutator does not ring, but gives out a flat sound when struck, the front Vee should be tightened.

The exposed portion of the front mica V-ring is normally a catchall for oil and dirt. This section should be cleaned and protected with a layer of surgical tape and twine to prevent flashovers and breakdown to ground. Red synthetic enamel will give a smooth finish, resistant to oil and carbon dust.

Uniform Spring Tension on Brushes Prevents Selective Action

Check the brush rigging carefully. Most brush holders in use today are box type, and the brush holder should be replaced when the inside broached section is worn.

The brushes themselves must fit properly, not so tightly as to stick, and not so loosely as to shift position when running. Make sure that the grade used is correct for the application, using the advice of the manufacturer of the motor. Also make sure that the fit of the brush on the commutator extends across the face of the brush.

The spring tension on the brushes should be uniform so as to prevent selective action. The correct pressure will vary with the design of the machine and adjustments should follow the recommendation of the manufacturer. The brushes should be staggered in pairs of arms to prevent grooving of the commutator. Brush shunts should be kept tight and free from excessive corrosion so that current will be uniformly distributed to the brushes. Under bad conditions of corrosive atmosphere that are often found on railroads, the shunts can be protected by dipping in melted paraffin or in synthetic red enamel or by covering with woven cotton tubing.

Resurfacing of the commutator should be done in a lathe, or with a grinding rig. As it is impossible to obtain a true surface with a hand stone, it should be used only as an emergency. Practically all up-to-date direct current machines have undercut mica in the commutators. This undercutting should be kept $\frac{1}{16}$ in. deep.

Lubricating Oils for Gearmotors

A gearmotor is a self-contained drive made up of a ball-bearing motor and a speed-reducing gear unit. It is designed to take advantage of the electrical efficiency of the high-speed motor and the transmission efficiency of accurately cut and properly designed gears.

Suggestions already given apply to the motor element of the gearmotor unit. Front end motor bearings are generally grease-lubricated and require the same attention as in standard ball-bearing motors. Rear bearings, gear box bearings, and the gears themselves are almost always splash-lubricated from the same oil supply reservoir in the lower section of the gear unit. Oil seals at each bearing prevent oil leakage into the motor windings and out along the driving shaft. The precision cut gears demand carefully selected lubricating oils. Use only top grade oils of the viscosity called for by the manufacturer of the gearmotor. Observe particulars as to type of units and operating conditions.

See that the oil level marked for each gearmotor unit is maintained. For normal operating conditions, drain the oil reservoir in the lower section of the gear case once a year and refill with new oil.

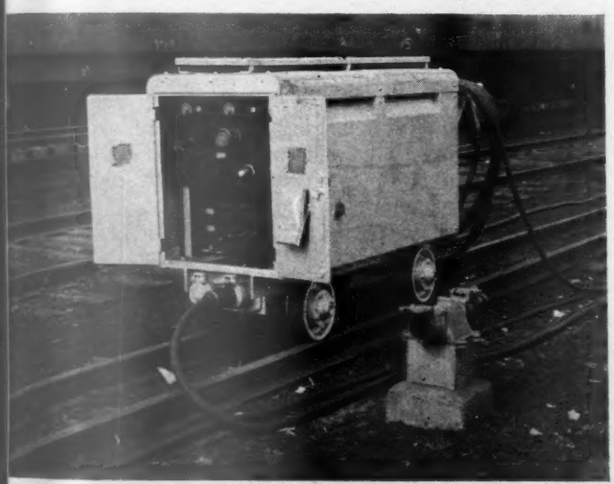
Charging Sets on Rails

War traffic proves capability of Jacksonville Terminal standby and charging power facilities

When in 1934, the battery charging facilities in the yards of the Jacksonville Terminal Company became inadequate, a new system of power supply was installed which now under war traffic conditions has been able to prove its effectiveness.

The old charging facilities had become too small and were also unsuited to changing conditions . The yard had been enlarged so the charging outlets were no longer in the load center of the yard. Line loss was excessive because of the great length of low-voltage leads, and feeder maintenance presented a difficult problem because the yard is laid on a swampy soil which causes the tracks to work up and down under trains, damaging the conductors under the tracks. Small clearance between tracks makes an overhead system impracticable.

The estimated cost of installing a direct-current charging system of adequate capacity was $25,000. Under present conditions this would not have fulfilled all requirements because of the demand for 3-phase, 220-volt standby power.



One of the 200-amp., 50-volt Electric Products Company charging sets —Three-phase a.c. power is supplied to the sets through Albert & J. M. Anderson receptacles mounted on the concrete foundation in the foreground

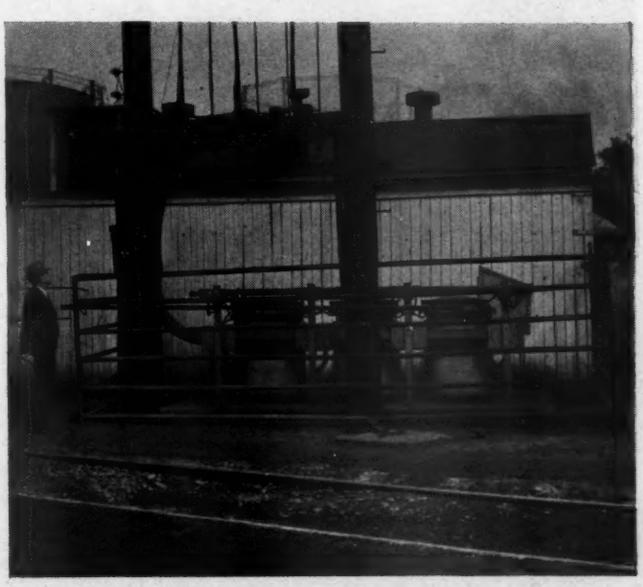
The system finally installed consists of a 3-phase, 220-volt distribution system, supplying cars directly with this kind of power, and portable 200- and 300-amp. motor-generators to supply d.c. charging current. The feature of the system which distinguishes it particularly is the fact that the sets are moved along the yard between cars on light narrow-gage track. One man can move a set easily, whereas ten men would have difficulty moving the same set along the soft cinder ballast.

There are four of the narrow-gage tracks, each about 550 ft. long. The gage is 18 in., the rail is 60- or 70-lb. rail and it is mounted on 24-in. lengths of standard ties spaced about 8 ft. apart.

Three-phase, 220-volt power is derived from a set of three 100-kva. transformers located at one side of the yard and this power is carried underground across the yard to the midpoint of each branch feeder cable which carries power along the narrow-gage, motor-generator tracks. The transformers also supply power for other requirements. The necessary current transformers, potential transformers and meter are located at the transformer station.

The main feeders consist of two 600-volt, three-conductor, 300,000-c.m. cables and the branches are 2/0. All underground cables are non-metallic and are laid in the ground without conduit. The three-phase, 220-volt outlets are spaced along the narrow-gage track 175 ft. apart; four to six on each track. They consist of Albert & J. M. Anderson, type F-4 duplex receptacles mounted on a concrete base. The feeders are brought up through a hole in the base which is filled with compound after the cables are brought in.

Connections between the outlets and the motor-generator sets are made with 100-ft. lengths of three-wire cable. This permits of placing the sets at any point on any of the four narrow-gage tracks. The same cables are used to supply standby power directly to cars equipped with a.c. motors.



The transformer bank which supplies the 220-volt power is self-contained, including disconnect fuses and metering equipment

The d.c. cables used to connect from the charging sets to the cars are 75 ft. long and consist of No. 2 Simplex 133-strand, Tirex cables, long enough to reach

four car tracks on either side of the narrow-gage track. When in use they are pushed under the rails when it is necessary to cross a track. The d.c. outlets on the sets are female receptacles while the d.c. cables have a male plug at one end and a female receptacle at the other, permitting the connecting of two or more cables together without the need for a separate connector. All plugs and receptacles were supplied by Albert & J. M. Anderson and are of 100-amp. capacity.

A total of 14 charging sets are used. Nine of these are 200-amp. 50-volt Electric Products Company machines, four are 300-amp., 50-volt E. P. machines and one is a Fairbanks-Morse machine which can be used to supply 90 amp. at 90 volts or 200 amp. at 50 volts. The latter machine is used for the charging of 64-volt cars and the 64-volt batteries of Diesel-electric locomotives. Some 110-volt cars also come into the yard, but these do not require charging. The 300-amp. charging sets have three outlet receptacles.

Control equipment on the sets is extremely simple. The generators are constant-current machines; no attempt is made to supply potential or modified potential control. The usual charging requirement consists of getting as much charge into the battery as possible in the limited time the car is available. Charging sets in service work at or near full load capacity.

There are three resistance control steps in each d.c.

D.c. charging cables from the sets on the narrow-gage track are pushed under the rails of adjacent tracks to reach cars on the other intermediate tracks

circuit and these allow for different current values in the two or three d.c. circuits to compensate for different sizes of batteries.

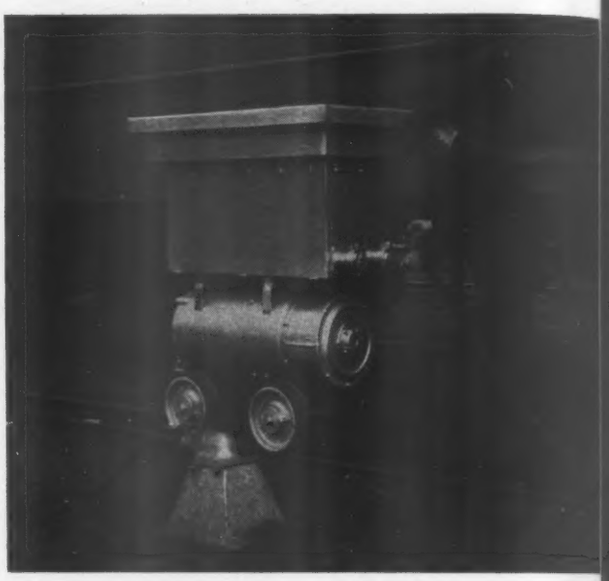
When one of two outlet circuits is disconnected, the voltage on the machine will rise. This causes a relay to operate which automatically disconnects the other circuit.

All machines are mounted on four 8-in. diameter, ball-bearing, flanged wheels. The two-circuit machines weigh about 1,800 lb.

Operation consists of checking the battery condition under full load when the car arrives at the station. If it is less than 28 volts, the battery is blue-tagged for charging.

The present system has about three times the capacity of the proposed new d.c. system which would have cost $25,000. The cost of the present system was less than $15,000. This increase in capacity is due in part to the flexibility of the system, the facility with which a car can be put on charge.

War conditions have increased charging requirements to about four times what they were before the system was installed and even the proposed d.c. system would now be inadequate; charging requirements are further increased by the use of old cars equipped with straight-storage systems and cars equipped with old types of axle lighting systems.



The Fairbanks-Morse 90-ampere set supplies power for 64-volt cars

At present from 30 to 82 cars are charged every 24 hours.

The system was designed and its present method of operation developed by L. R. Andrews, electrical engineer, Jacksonville Terminal Company, Jacksonville, Fla.

* * *

A Diesel-electric switching locomotive frame being put together with electric welding at the Erie, Pa., works of the General Electric Company. When completed, the locomotive will be an 80-ton, 500-hp. switcher and will serve on an industrial railroad in a large steel plant

CONSULTING DEPARTMENT

Life Insurance for V-Belts

Can you suggest ways and means of improving the performance and increasing the life of endless V-belt drives such as are used for railway passenger car air-conditioning compressors?

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York.

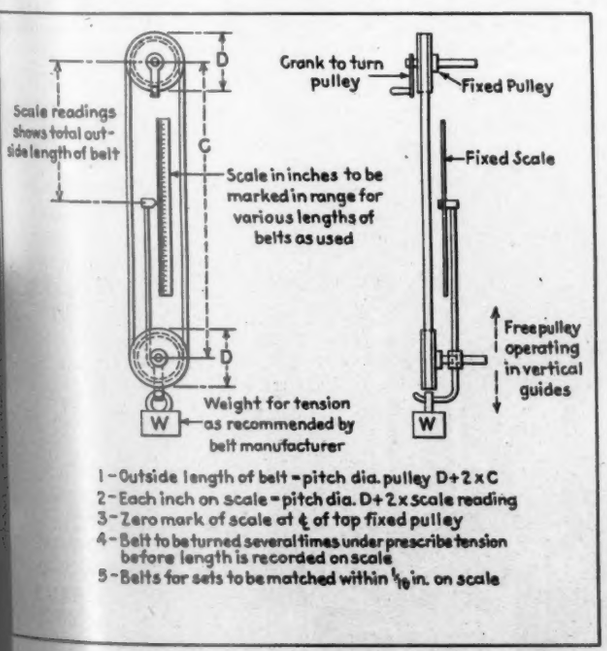
What suggestions can you offer for conserving the limited amount of Freon available for use in air-conditioned passenger cars?

Use Only Matched Sets

Under present operating conditions, there is greater need than ever before for improving performance and increasing service life of V-type endless belts. Multiple V-belt drives for the conventional design of compressor drives usually consist of from five to seven belts. Certain application requirements must be met and adjustments made if these drives are to be efficient and have normal service life.

The first requirement of the multiple belt drive is equalized tension on all belts. Any difference in belt tension between the individual belts results in an overloading of the tight belts, which causes rapid wear and frequent failures.

The belts are usually furnished by the manufacturer in matched sets, but in application it is often necessary to break up matched sets, which results in stock of odd


D
Crank to turn pulley
Fixed Pulley
Scale readings shows total outside length of belt
C
Fixed Scale
Scale in inches to be marked in range for various lengths of belts as used
D
Free pulley operating in vertical guides
Weight for tension as recommended by belt manufacturer
W
W
1 - Outside length of belt = pitch dia. pulley D + 2 x C
2 - Each inch on scale = pitch dia. D + 2 x scale reading
3 - Zero mark of scale at ℄ of top fixed pulley
4 - Belt to be turned several times under prescribe tension before length is recorded on scale
5 - Belts for sets to be matched within 1/10 in. on scale

Schematic arrangement for endless V-belt matching machine

new belts. Failure of one or two belts of a matched set often requires the removal of the balance of belts which are in good serviceable condition. To provide the most efficient drive and increase service life, the use of a simple belt matching machine is recommended.

The attached print shows the basic elements of the device and recommended practice for operation. This machine may be constructed of second-hand or stock material. The arrangement as shown is for vertical setup, which allows the most simple design. The device may be mounted on a wall, thereby requiring little or no floor space.

The belts to be matched should be of same type and manufacture, and of same age and service life, since it is important that all belts of a matched set have the same physical characteristics to insure that each belt will carry an equal share of the driving load. The matched sets of reclaimed belts should be tied together and plainly marked for actual length and type of compressor application for which the length is used.

Extreme care and patience should be exercised in the application of belts. Many belts are ruined in application by forcing belts over pulleys without backing off the belt tension adjustment on the motor or compressor support. With the present scarcity of critical material as involved in belts, it is time well spent to make belt application in the proper manner.

The design and operation of the belt tension device is important for two major reasons; it must provide a suitable means for applying belts and it must maintain the proper tension to produce the most efficient drive and longest service life. Since the belts are subjected to a wide range in temperature and tension under normal operating conditions, the tension device should be frequently inspected and adjusted and, if possible to incorporate, the tension device should be equipped with a spring of sufficient capacity to hold belts at the recommended tension throughout their variation in length under load.

For the non-cooling period, the belts should be left on pulleys with tension reduced. At the start of cooling service, the tension on belts should be carefully inspected after first trial operation because belts shrink when not in service or under prescribed tension, thereby requiring tension adjustment until normal length is reached.

AIR-CONDITIONING ENGINEER

The War Production Board is doing its utmost to locate every idle electric motor and generator and get it back into active service. To assist industry in locating the idle motors and generators, the General Industrial Equipment Division has set up a Used Motor Unit in its Electrical Equipment Branch. The unit has a file of about 30,000 used motors and generators including those listed by motor dealers with the OPA and those available in industrial plants. The Unit is under the direction of C. A. Sievert, former president of the National Industrial Service Association, who has had a long experience in the used motor field.

NEW DEVICES

Lubricators For Driving Journals

Performance records are now available which indicate that the principles of mechanical lubrication of driving-wheel journals incorporated in the Hennessy mechanical journal lubricators are both satisfactory in service and economical in operation.

The outstanding feature of this driving

Driving box in which a Hennessy lubricator has been installed

journal lubricator is a submerged pump of sufficient capacity to furnish an oil bath to the journal at all times while the locomotive is in operation. The pump is actuated by the lateral movement of the locomotive with respect to the axle operating on contact rods. Special wipers, held against the journal on the hub end, permit ample oil to reach the hub faces. A similar wiper and extension on the end plate of the lubricator prevents loss of oil on the inside of the driving box. In case of failure of the pump, the lubricating distributor holds enough oil so that journal heating will be slow and warning given before extremely high temperatures are reached.

The lubricator displaces the conventional cellar. Application does not require change to either the driving box or the journal. The unit is completely self contained, no adjustments being necessary. Attention required consists of the usual inspection and replenishing of oil after each run and removal from the driving box for thorough inspection of all parts and cleaning at intervals of from three to six months, dependent upon the service of the locomotive. Usually this work is done when tires are turned. Valve oil is used during the summer months and heavy lubricating oil with a low pour test during the winter months or freezing weather.

On locomotives tested by the Pennsylvania at St. Louis, Mo., in 1904, where grease lubrication and oil lubrication were compared, friction losses on driving journals and crank pins were reported 75 to 100 per cent greater with grease than with oil. Friction horsepower in percentage of indicated horsepower ranged from 7 to 22 per cent with oil and from 15 to 27 per cent with grease.

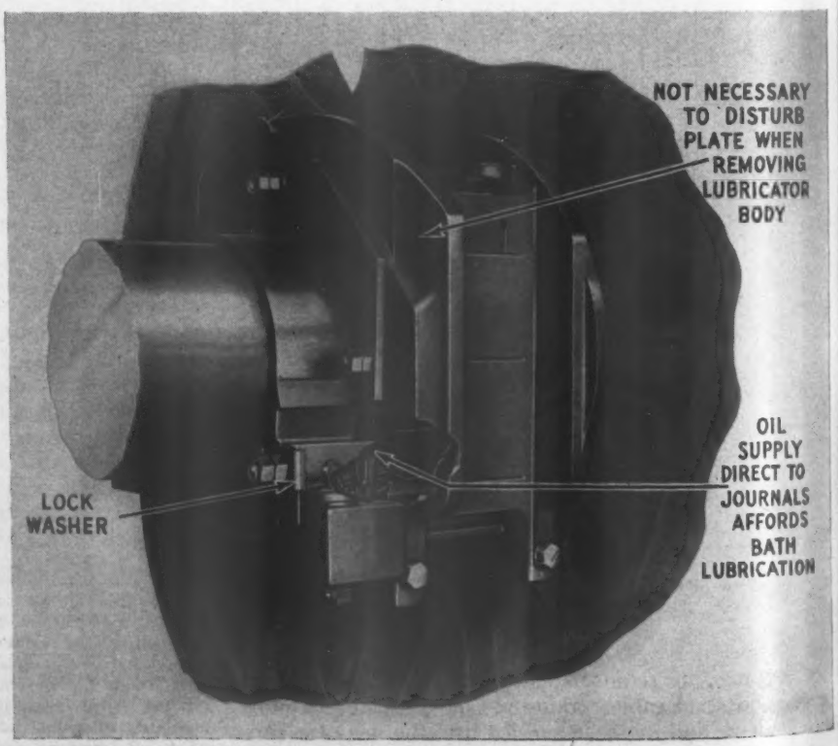
The conclusions from tests made at Purdue University in 1906 on an Atlantic type locomotive weighing 90,000 lb. on the drivers were stated in a report presented by Prof. W. F. M. Goss before the American Railway Master Mechanics' Association in 1908 as follows: "Accepting the oil lubrication as a basis of comparison, it appears that at 20 m.p.h. the loss of power resulting from the use of grease is slight, so small in fact as to be almost negligible, but as the speed is increased the loss is increased and at 60 m.p.h. it amounts to from 140 to 160 hp. The equivalent coal loss, assuming 4 lb. of coal per hp. hr., is something more than 500 lb. per hr."

Heavy journal loads, high speed and long runs have all increased the difficulty of lubricating driving journals with grease. As loads and speeds increased, the use of a harder grease became necessary. The higher melting point has caused the grease in contact with the journal to bake over or dry out, thus causing a further rise in temperature and increased wear both on bearings and journals, and increasing the development of heat checks in driving-axle journals.

A series of 12 4-6-6-4 locomotives on which Hennessy lubricators were initially installed and which operate in high-speed heavy-duty territory have accumulated more than 1,200,000 miles of service. With grease lubrication, experience on the road on which these locomotives are used indicates that the main bearings would have been taken down for renewal three times and would have had all journals out at least twice within that period of service. It is estimated that the saving in material and labor approximates $40,000. No trouble has been experienced with heating on any of the journals. During the month of December, 1942, the average oil consumption for each locomotive was 21.5 gals. in tender boxes, driving boxes, and trailer-truck boxes. This represented a lubrication cost of less than 50 cents per 1,000 locomotive miles for all driving journals.

A locomotive of the 4-8-2 type, one of six in high-speed passenger service, has made 265,000 miles and, although the tires have been turned, no crown bearings, with the exception of one renewed because it became loose, have been replaced or turned. On this same locomotive it has not yet been necessary to turn the journals.

A 4-6-2 type locomotive with driving journals equipped with Hennessy lubricators ran 100,166 miles with an average journal wear of 0.008 in. from the nominal diameter of the new journals. In the following 90,191 miles the wear from the time of the first measurement averaged 0.034 in. This represents a total average journal wear of 0.042 in. in almost 200,000 miles of passenger service. While this mileage was being accumulated, no work was re-


NOT NECESSARY TO DISTURB PLATE WHEN REMOVING LUBRICATOR BODY
OIL SUPPLY DIRECT TO JOURNALS AFFORDS BATH LUBRICATION
LOCK WASHER

Driving box and cellar cut away to show the parts of the Hennessy lubricator

quired on the crown bearings and no journals were turned.

Electric locomotives of the 2-8-2 + 2-8-2 type which formerly used approximately 500 cakes of grease a year are now operating with lubricator-equipped drivers at an oil cost of less than 50 cents per thousand miles of service. In addition, these locomotives, which formerly required inspection at intervals of about eight hours, now require inspection only once in 36 hours. They are making about 25 per cent more mileage now than when lubricated with grease.

Hennessy lubricators have now been applied on 28 railroads to motive power used in all classes of service. The savings effected by oil lubrication of driving journals are in the cost of lubricant; reduction of labor expense associated with the provision and renewal of grease cakes and reconditioning of screens, and elimination of the necessity of inspecting driving boxes at intermediate terminals on long runs.

Emergency Lighting Unit

Requiring no fixtures or wiring other than plug-in connections to the a.c. supply, the Exide Lightguard emergency lighting unit

The unit goes into service automatically

for war-time service is announced by The Electric Storage Battery Company, Philadelphia, Pa. It throws a beam of light 50 ft. wide a distance of 150 to 200 ft., covering an area of 7,500 sq. ft.

In the case of a power failure on the regular lighting system, the emergency unit is switched on automatically. The only maintenance required is the occasional adding of water. Recharging is done automatically by trickle charge. The state of the charge is clearly indicated by pilot balls.

Illumination is supplied by a sealed-glass type, prefocused auxiliary driving lamp (Mazda 4010) similar to those used on automobiles; a replacement can be obtained at most automobile accessory stores.

The unit is 16½ in. long by 6¼ in. wide by 18 in. high. The battery is a 3-cell Exide, type KZHGR-7 with thick plates assembled in a glass jar. It is a self-contained unit weighing 47 lb. and may be moved from its customary place to meet the needs of an emergency.

Ventilating Welding Operations

A fume exhauster, intended especially for use in connection with welding operations and which can be used on from one to six working stations, is being manufactured and distributed by the Chelsea Fan &

Six welding stations can be accommodated by this fume exhauster

Blower Company, Inc., Irvington, New Jersey. Known as the Octopus, this exhaust unit is so designed that fumes, gases, dust, filings and grinding compounds do not come in contact with the motor at any time while the unit is in operation. A 3-hp. motor is used to operate the blower wheel and the motor is tested to an 80 per cent overload. Six 3-in. hose connections can be operated from the unit and provide an exhaust of 245 c.f.m. of air when hose lengths are 100 ft. Using 10-ft. lengths of hose, the exhaust capacity is 400 c.f.m. The Octopus will accommodate four 4-in. hose connections if that arrangement is desired. Exhaust capacities then are 325 c.f.m. and 600 c.f.m. Reversing the position of the tube adapters converts the unit into a blower for ventilating purposes. A smaller model, the Octopus, Jr., will accommodate four 3-in. hose connections or three 4-in. outlets. Caps are provided to cover connections not in use.

Hanger for Fluorescent Lights

To save time in installing and cleaning its new line of composition reflector fluorescent fixtures, Sylvania Electric Products, Inc., Salem, Mass., announces the Captive Latch, a spring-type fastening that holds the reflector securely to the top housing.

The latch requires only a quarter turn to remove the reflector. No tools are needed and since the latch is an integral

A quarter turn of the spring hanger locks the fixture in place

part of the top housing, it cannot become loose and drop out. The latch is inconspicuous in its position between the lamps and in no way affects the appearance or efficiency of the reflecting surface.

Hand Drills With Plastic Housings

Using a new plastic material called "Drillite", Black & Decker, Towson, Md., has designed practical housings for its ¼-in. standard drill and a ⅜-in. standard drill, which offer many advantages. Drillite plastic is made with a shredded cotton-duck base, which gives it a high impact resistance, and enables it to withstand considerable abuse and wear. The plastic is

Reduced weight of these drills with plastic housings gives a higher ratio of power per pound of tool weight

also heat resistant, and an insulator against dielectric shock. The housings are smooth and easy to handle.

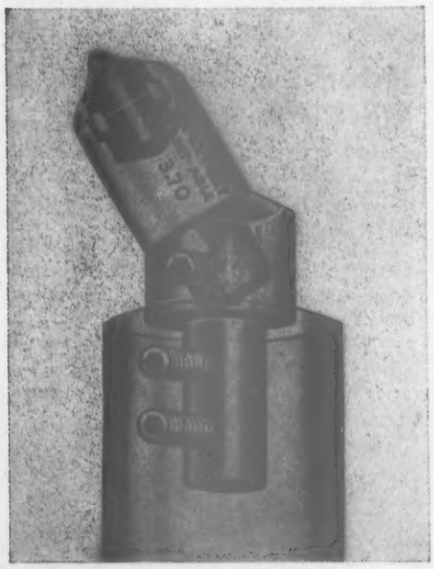
Steel inserts have been cast into the plastic housings to carry all ball bearings, and threaded steel inserts are cast in the field housing for housing assembly screws.

Steel air vents in the commutator-end housing insure ample motor ventilation.

There is a marked reduction in the weight of the complete unit as compared with former models using metal housings. The net result in the ¼-in. and ⅜-in. standard drills is a higher ratio of power per pound of tool weight. Both units are offered with either end-handle or side-handle control, equipped with a pistol grip and trigger switch; and with universal motors, operating on either alternating or direct current.

Angle-Set Diamond Holder

A 30-deg. side-angle lock-set holder which enables bullet-nose grinders, using centerless grinders with a templet attachment, to use common quality diamonds to form

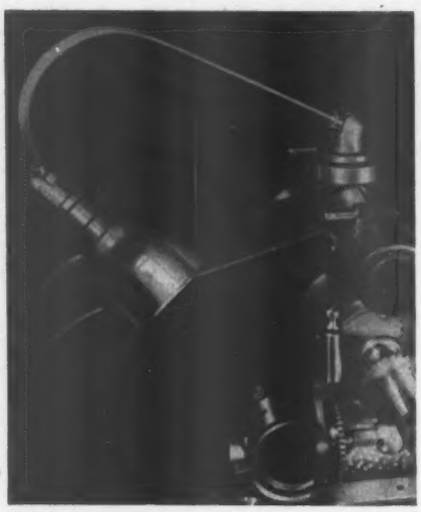


Angle-setting of this holder prevents wear in wheel dressing

grinding wheels by dressing from a one to six in. radius has been developed by the Diamond Tool Company, 938 East Forty-first st., Chicago. The mean fixed position left or right in which the diamond nib is held prevents wear to the setting in the dressing operation and eliminates the use of thin diamonds and weak points for dressing. Rotation of the nib presents a new sharp edge of the diamond to the wheel being dressed.

Local Lighting

For those lighting requirements which cannot be met satisfactorily by general illumination, the Reliance Devices Company, Inc., New York, is offering a line of adjustable lighting units known as Swivelier Work-Lites. Because of spring tension in the joints the units will not work loose or drop down. They are easy to adjust, requiring



A Work-Lite unit as applied to a milling machine

no wing nuts or set screws. The arm of the unit is adjustable through 90 deg. and the base may be rotated 350 deg. The socket may also be swung through a 90-deg. arc and rotated 350 deg. The arms are made in 6-, 12-, and 18-in. lengths and the reflector shades are made in three shapes—cone, bell and parabola. A stop prevents the twisting of wires and the unit is completely enclosed to protect it from oil and dirt.

Megger Insulation Tester

The James G. Biddle Company is now manufacturing in its Philadelphia factory the first U. S.-made Megger instruments for

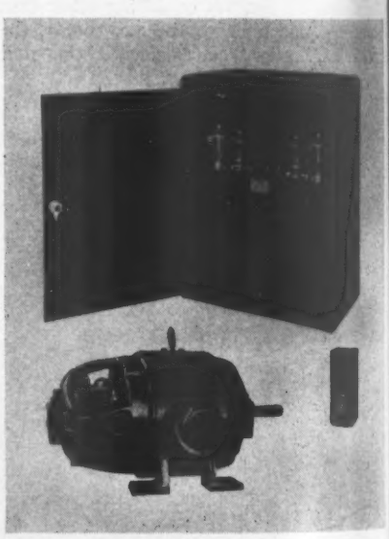
Megger insulation tester in molded Bakelite case

testing electrical insulation resistance, and expects to be in full production about June 1 of this year. The new testers are of the hand-generator and direct-reading ohmmeter type and of the same general design as the Meg and Super-Meg insulation testers previously marketed by this company.

The cases are made of impact-resistant thermo-setting phenolic molded material. The sections of the case fit together to form a unit that is dust-proof and practically splash-proof. The entire instrument, including the ohmmeter moving system, generator, driving gears, binding posts, etc., is built in Philadelphia directly from raw materials and fabricated parts. The manufacturer emphasizes the point that the instruments are not an assembly of "store parts" and that their construction does not depend upon the finished product of any other manufacturer.

Motor Speed Control

An a.c. electronic adjustable speed drive is announced by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. It consists essentially of a d.c. motor with separate electronic control of armature and field currents. By grid-control of rectifier tubes, the armature current may be adjusted from zero to maximum without



The adjustable speed drive consists of an electronic control cabinet, a push-button control station and a d.c. motor

steps, while the field current is held at full value. Further increases of motor speed are obtained by reducing the field current. A current limiting feature prevents overspeed. Dynamic braking and extremely fast reversals may be obtained with black commutation. The drive provides constant torque for all speeds up to the base speed of the motor and constant horsepower above base speed. Small sizes of motors are operated from single-phase power and two- or three-phase power is used for larger sizes.

Speeds may be preset, within the design range. With two speed-control potentiometers and reversing contactors, different forward and reverse speeds may be preset

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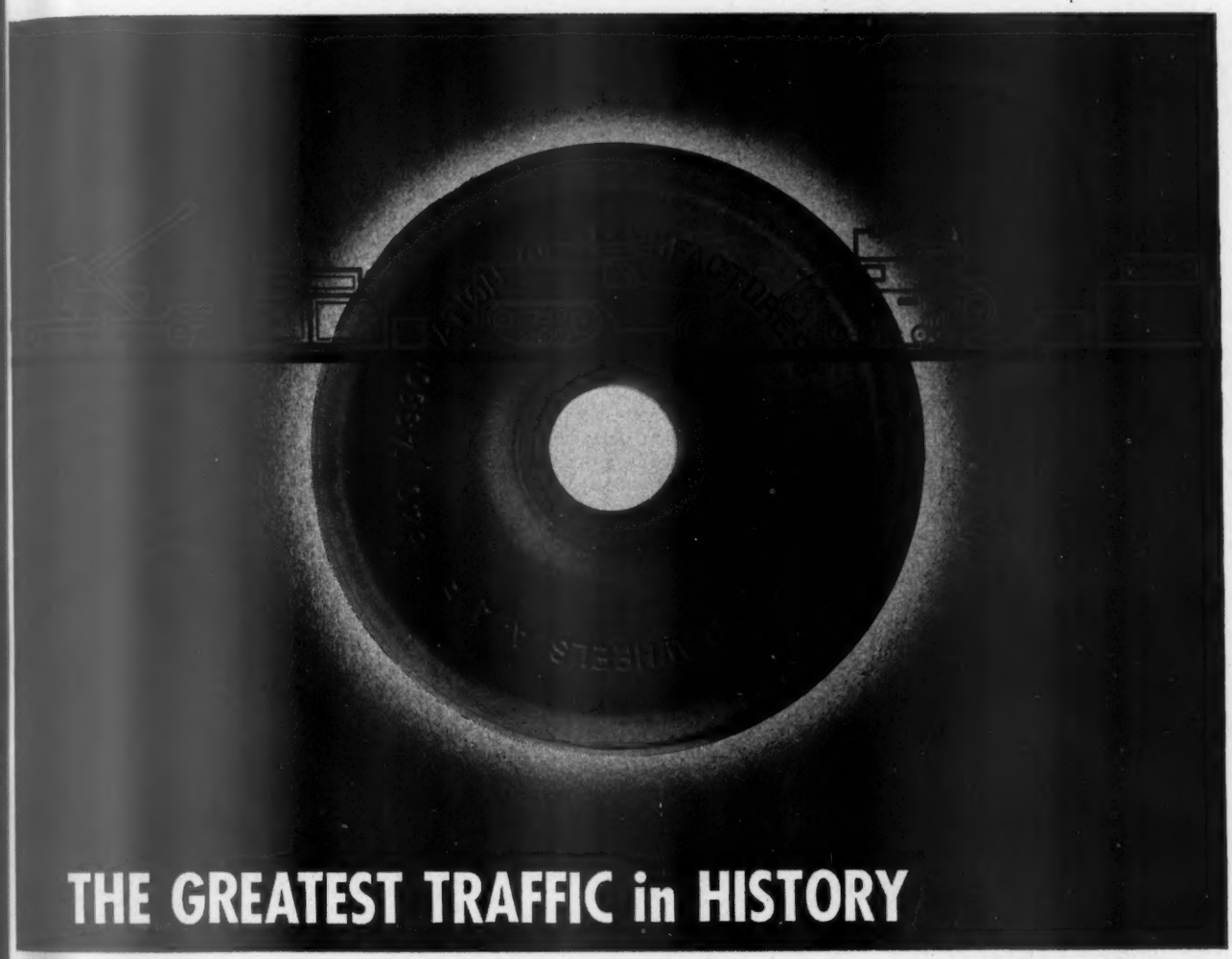


THE GREATEST TRAFFIC in HISTORY

ROLLED ON RAILROAD WHEELS!

In 1942 the railroads handled the largest volume of freight traffic in history, under the most difficult conditions. The first full year's operation under wartime restrictions has demonstrated again the ability of the railroads to do the "impossible"

Continuation of such severe operations will collect its toll in wear of equipment and trackwork. Even the most stringent maintenance program cannot prevent this wear. This will add to the already complicated problems of the railroads, as most of this equipment will be difficult to replace.

The wear on Chilled Car Wheels, which carried most of this record-breaking freight load, is not a serious problem because: Worn Chilled Car Wheels are quickly recast into new and better wheels with the use of very little additional metal. Thus Chilled Car Wheels will materially aid the railroads in handling the still greater loads expected during 1943.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW

3266

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

so that only the operation of the forward or reverse push buttons is necessary to obtain a predetermined speed in either direction. Speed adjustments may be made at any time while the motor is running.

Speed control is effected by potentiometers which change the firing point on the a.c. line voltage wave at which the tubes fire, varying the output d.c. voltage as required.

Filtered Incandescent Light

A line of incandescent lamps having pale green bulbs is being manufactured under the trade name Verd-A-ray by the Save Electric Corp., Toledo, Ohio. The colored glass filters out from 5 to 15 per cent of the light at the red end of the visible spectrum. The manufacturer states that since this increases the proportion of yellow-green light in the lamp output (that part of the spectrum to which the eye is most sensitive) the lamps provide a better color mixture for seeing and reducing glare. The light output is not cold, as might be anticipated, but is pleasing to most observers.

Locomotive Boiler Blow-Off Arrangement

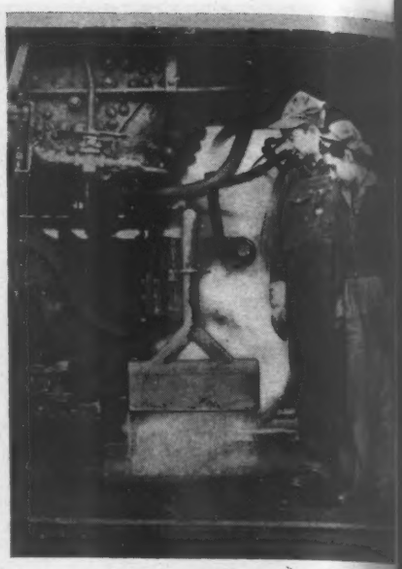
The road blowing of locomotive boilers has been a necessity for nearly 50 years. Previous to that time, it was possible to allow the concentration of dissolved salts and insoluble matter to accumulate until the boilers could be washed out. As pressures and corresponding boiler temperatures increased, dissolved and undissolved solids gave more and more trouble; and the wasting of concentrated waters from locomotive boilers became an absolute necessity with the advent of water treatment. In early experience with road blowing, the locomotive boiler blow-off cocks were blown openly, sometimes causing the destruction of ballast, damage to property, or injury to personnel.

In later years, with greatly extended locomotive runs, methods for disposing of the blow-off cock wastage on the road had to be revised. This led first to the use of baffling devices under the cab decks, but the complaints of roadway maintenance officers about the destruction of ballast multiplied rapidly, and these complaints were eventually supported by equipment-maintenance officers when under-body machinery began to show rapid deterioration, culminating when air-conditioning equipment generally commenced to be installed under car bodies.

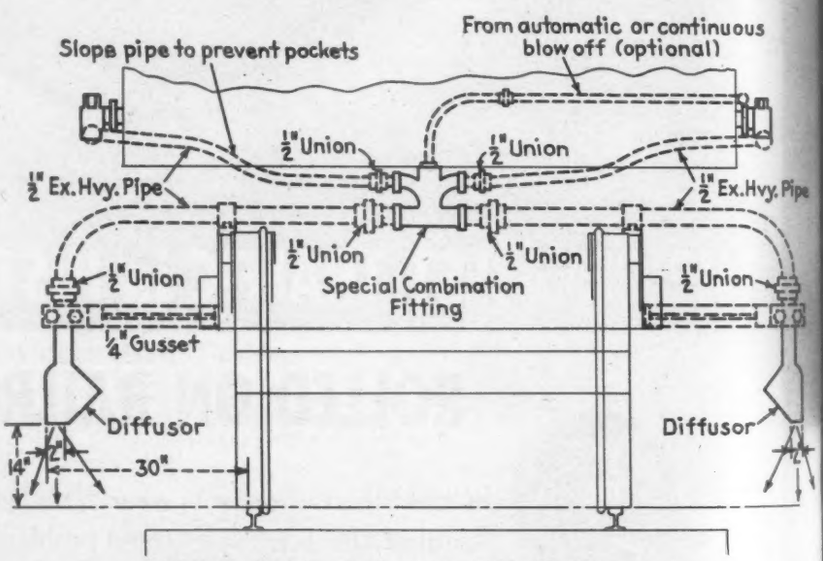
A radical improvement in the disposition of boiler blow-off cock wastage, developed by the Wilson Engineering Corporation, Chicago, was represented in a centrifugal muffler or separator mounted on top of the boiler. This device separated the steam flash from the solid water, delivering the former to the atmosphere and the latter by gravity alone to the tracks. It is widely used today, but has the disadvantage, in cold weather and in some districts, of permitting of the recondensation of a small proportion of the steam flash on the boiler jackets and cab windows. This has resulted in local complaints accordingly, although these complaints are not general, and are in small proportion to the large number in service.

A new type of equipment for the road blowing of locomotives, shown in the illustrations, has been developed on the Southern Pacific and is now being made and supplied to individual railroad requirements by the Wilson Engineering Corporation. This device, known as the Locomotive Blow-off Diffusor Set, returns to the earlier baffling principle, but with a wider spread than heretofore in diffusion of pressure and distribution of boiler wastage to both sides of the locomotive without damage to the ballast. A special combination fitting, centered just ahead of the boiler throat sheet, is piped to receive the discharge from each blow-off cock, and from the continuous blow-off valve (if used), and to deliver this discharge each way from the center to the Diffuser units on both sides of the locomotive. The discharge, again split at each Diffuser unit and broken up by a narrow horizontal bottom plate, or ledge, is brought outside the tie ends and as low as clearances allow, in most cases about 14 in. vertically and 30 in. laterally from the rail head.

A large number of locomotives on the Southern Pacific Lines have been equipped with this device, and new locomotives now under construction by the Baldwin Locomotive Works and the Lima Locomotive Works are specified to include this equipment.



Wilson locomotive blow-off diffuser applied to a Southern Pacific locomotive



Method of piping the locomotive blow-off diffusor set

Diffuser on the right side of the locomotive—A similar unit is located on the left side

(*Turn to next left-hand page*)

Careful finish of the entire surface of Lima rods prevents formation of incipient cracks that might develop into full fledged flaws.

LIMA-BUILT POWER

. . . . IS DEPENDABLE POWER

The splendid record made by American railroads in motive power utilization during 1942 (87.8% in the peak month of October) is graphic evidence of the inherent quality and dependability of modern locomotives.

Dependability has been built into the Lima locomotives now serving many American railroads . . . dependability gained by specialized manufacturing methods, skilled craftsmanship and an experience stretching over three quarters of a century.

LIMA LOCOMOTIVE WORKS — LIMA LOCOMOTIVE WORKS INCORPORATED — INCORPORATED, LIMA, OHIO

High Spots in
Railway Affairs . . .

Women Employees On the Railroads

In mid-January of this year there were 63,187 women employees on Class I railroads. This was 4.79 per cent, or less than one-twentieth of the total number of employees—1,319,480. These figures are taken from the first of a new series of quarterly statistical statements to be issued by the Bureau of Transport Economics and Statistics of the Interstate Commerce Commission. The great bulk of these 63,187 women employees, or 48,138, were classed as professional, clerical and general. Of the 745 women employees in the maintenance of way and structures department, 375 were classed as extra gang workers and 260 as section workers. Of the 9,439 in the maintenance of equipment and stores departments, 3,263 were classed as coach cleaners; 2,629 as general laborers in shops, enginehouses and power plants; 1,386 as general laborers in stores and ice, reclamation and timber treating plants; 1,039 as skilled trades helpers in the maintenance of equipment and stores departments; and 1,005 as classified laborers in the shops, enginehouses and power plants. While 4,843 women were employed in the transportation department other than train, engine and yard, only four were classified under the head of transportation (train and engine). These were designated as road passenger brakemen and flagmen.

Engineering Pays Dividends

R. C. White, chief operating officer of the Missouri Pacific, in speaking before the Engineers' Club of St. Louis recently, commented upon the marvelous advances which have been made in railway efficiency and service since the first World War. He said he was "proud of the fact that engineering skill, engineering brains and engineering patience and perseverance, have been factors in making all this possible." At another point in his address he mentioned specifically some of the contributions that have been made by the engineers. These included the development of centralized traffic control; reduction in rail and mechanical failures through the use of electro-magnetic detectors; the equipping of locomotives with roller bearings, light alloy reciprocating parts, and superheated steam; the development of the Diesel locomotive; and the adaptation of the telephone, radio, teletype and photography as factors in increasing the over-all speed of cars from the point of origin to the point of destination.

Oil Movement Records To East Coast Broken

The movement of petroleum products into the East Coast area broke all records in the week ended April 3. The daily average tank car deliveries were 912,919 barrels, while 21,047 barrels a day came in drums loaded into box cars—a grand total of 933,966 barrels a day. This compares with the previous high record of 856,710 barrels a day during the week ended September 19, 1942. Meanwhile, construction of additional facilities for unloading tank cars at oil terminals is under way. It is expected by this means to increase the daily handling capacity by about 200,000 barrels. In all, there are 23 of these projects, extending from Norfolk, Va., to South Portland, Me., which will involve an expenditure of about one million dollars. The conversion of 100 steel gondolas, formerly cement carriers, is being completed to handle kerosene and fuel oil. They are being fitted with steel tanks for this purpose. Ten of the projected fifty Flexitank cars are nearing completion.

Travel Rationing Is Not Necessary

There have been widespread rumors to the effect that the Office of Defense Transportation would apply priorities to civilian train and bus travel. ODT Director Eastman declared on March 30 that these were "completely and entirely false." In further explanation Director Eastman said: "It is perfectly true that passenger transportation facilities are under severe strain. For this reason I have repeatedly urged, and I urge again, that people who have no real need to travel stay off trains and buses. If they will do so, the railroads and bus lines will be able to accommodate all the essential travel, and there will be no need to apply any compulsory restrictions. I still bellieve we can rely on the patriotic co-operation of the American people to avert any necessity for travel control by rationing or priorities."

Rail to Russia

According to Lend-Lease Administrator E. R. Stettinius, Jr., the lend-lease shipments from this country to Russia up to February 1, this year, have included a large amount of railroad material. Among them were 75,000 tons of rails and 17,000 tons of other equipment for the Soviet railways. A total of 580,000 tons of steel has also been shipped to Russia.

Rate Reductions

The Interstate Commerce Commission, by a close vote of six to five, has suspended the freight rate increases averaging 4.7 per cent, which became effective March 1, 1942. The increases in interstate standard passenger fares, which became effective February 10, 1942, were not disturbed, although the authority for the 6 per cent increase in interstate commutation fares, then granted, was revoked. Provision has been made, however, for independent hearings on these interstate commutation fares. Increases granted in rates on milk and cream, handled in either freight or passenger trains, were also suspended. Because of a tie vote between the commissioners, Mr. Eastman joined with them in making a decision, and thus cast the deciding vote. Joining with him were Commissioners Aitchison, Lee, Mahaffie, Splawn and Rogers. Separate dissenting opinions were filed by Chairman Alldredge and Commissioners Johnson, Miller, Patterson and Porter. The report indicated that the decision to suspend the freight rate increases was reached on April 6. It thus preceded the "hold-the-line" executive order of President Roosevelt on April 8, which, among other things, admonished federal and state regulatory authorities to disapprove rate increases and, if possible, effect rate reductions to keep down the cost of living and further the anti-inflationary purposes of the economic stabilization program.

Army Railroad Traffic

The Transportation Corps announced recently that during the first twelve months of the present war, the American railroads handled 41 million tons of army freight. This compared with 11,224,427 tons handled in the period from July, 1918, to June, 1919, which included the peak month of freight movement during World War I. The heaviest monthly movement of the last war was 1,445,535 tons, as compared to the largest monthly movement during the first year of the present war of 5,600,000 tons. During the first year of the present war the railroads handled 11,641,838 troops, about 60 per cent of which traveled on special trains. More than 55,000 open top cars for carrying equipment were included in the 21,000 special trains, the make-up of which also required 197,288 passenger cars and 79,443 baggage and freight cars. Cargo shipped to overseas troops now averages 82 lb. per man per day, as compared with 43 lb. in a comparable period for World War I.

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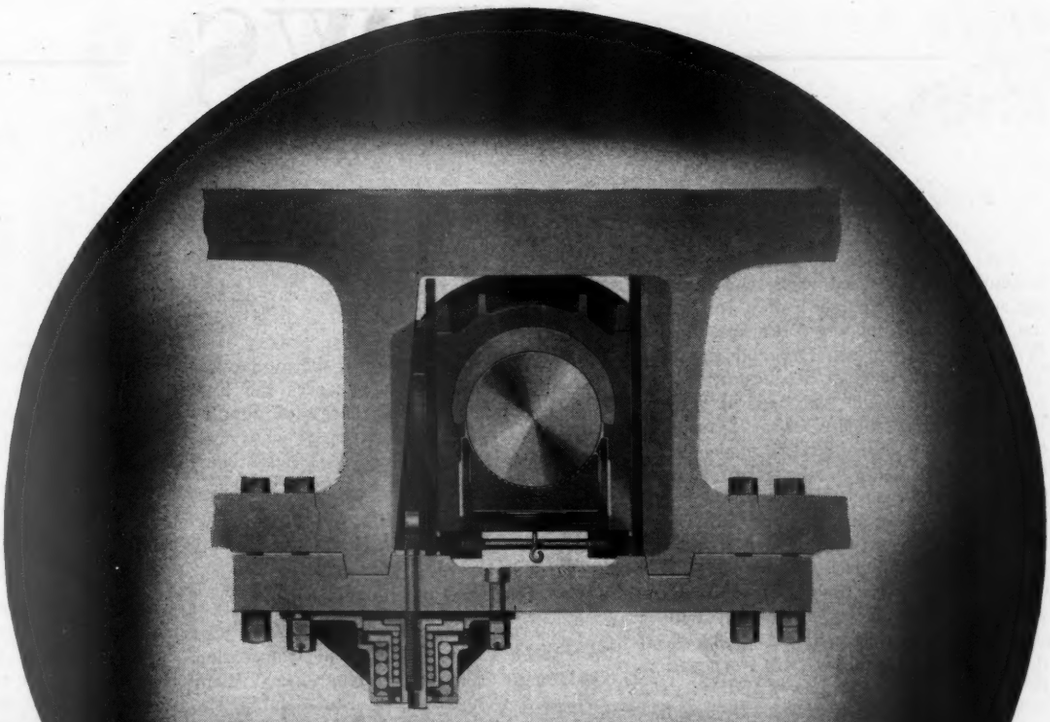


BEARING PROTECTION *for* *Overworked* LOCOMOTIVES

Locomotives were never worked harder than today. Never has it been more important to keep them on the road.

Thousands of locomotives are running longer between shoppings thanks to their Franklin Automatic Compensators and Snubbers.

This Franklin device compensates for driving box expansion due to temperature change and other operating conditions. It has ample reserve strength to take care of the high piston thrust of large locomotives and at the same time there is no chance for tight or stuck boxes.

By maintaining accurate driving box adjustment, the Franklin Automatic Compensator and Snubber increases locomotive mileage between shoppings and greatly prolongs the life of every bearing on the locomotive.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

NEWS

Freight-Car Conversions and Oil Movement

ONE hundred steel gondolas—former cement carriers—fitted with steel tanks in the shops of the Lehigh Valley at Packerton, Pa.; the Delaware, Lackawanna & Western at Scranton, Pa., and the New York Central at East Rochester, N. Y., will handle kerosene and fuel oil between Destrehan, La., and Chelsea, Mass., according to an announcement made by the Office of Defense Transportation on April 9.

The first 10 of a projected 50 "Flexitank" cars are expected to be in service shortly, the announcement added. These cars, which are automobile box cars fitted with canvas "balloons" processed with a rubber substitute, are being prepared at Aurora, Ill., by the Flexitank Corporation. Because of material shortages and costs the so-called Mareng cells will not be installed in box cars for commercial use at present, the ODT statement indicated, while experiments are still going on with the Baltimore & Ohio's plan to install corrugated steel tanks in automobile box cars.

Mechanical Committee, ODT, Meets in Chicago

MEANS of alleviating motive-power shortages, full utilization of cars and locomotives, and labor conditions were topics of discussion at the first annual meeting in Chicago on April 16 of the chairmen of the regional mechanical committees of the Office of Defense Transportation. Shannon Kuhn, deputy director in charge of locomotives of the ODT Division of Railway Transport, presided at the meeting, and C. J. Wolfe, associate director in charge of mechanical operations of the same division, spoke on the problem of keeping locomotives and cars in constant repair.

Reciting comparative statistics to show how the utilization of motive power has increased, and the number of locomotives and cars out of service for repairs has decreased, since 1940, Mr. Wolfe stressed his belief that the committee's most important task in the immediate future is to hold the line of current accomplishments in the face of increasing manpower problems. Wider employment of women and reduction of absenteeism through more intensive supervision were urged by Mr. Wolfe as means to overcome labor shortages.

Participating in this meeting was the recently established Chicago office, in charge of James E. Friend, deputy director. Mr. Friend, who had been deputy director in the Washington office, formerly was master mechanic of the Texas & Pacific at Fort Worth, Tex.

Other officers in the Chicago office are Albert V. James, locomotive assistant, and Frank J. Swanson, car assistant. Mr. James, transferred to the ODT from the War Department, was master mechanic of the Union Pacific, and Mr. Swanson, already on the ODT staff, was car department supervisor of the Chicago, Milwaukee, St. Paul & Pacific.

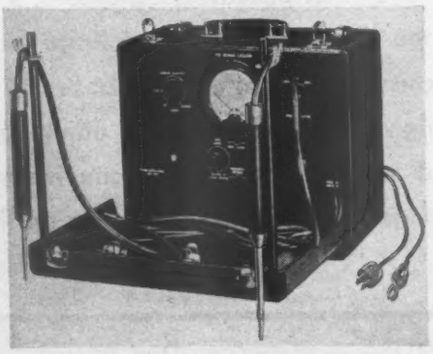
The Washington office of the mechanical operations section, which serves the East and the South, is in charge of Stanley Bliss Riley, deputy director, who was, until his retirement in 1939, general manager of the Pittsburgh & West Virginia.

"Silver Dollar Award" Combats Absenteeism

A SILVER dollar award for workers who have been 100 per cent on the job during the month has been adopted by William Sellers & Company, Inc., Philadelphia, Pa. The silver dollar, attached to a card which announces that the recipient is a member of the "Sellers 100 Per Cent Club," is placed in the regular pay envelope the first pay day of the succeeding month. The first presentation was made on March 12. A substantial cash award, in addition to the regular pay, is also to be given an employee who receives five silver dollars. Publicity is being given to the plan so that merchants and banks will not recirculate nor "make change" with the silver dollar. The employee or employee's family will thus enjoy the full significance of the award.

Waugh Builds Surgical Device for Armed Forces

THE Waugh Equipment Company is delivering its first orders for "Berman metal locators" to the medical services of the United States Army and the United States Navy. The development of this device, which promises to aid surgeons in saving lives during the present war, is the invention of a railway electrical engineer and is manufactured by a railway supply company. During 1939, while engaged in series of tests for the New York Subw System, the engineers of the Wa Equipment Company became interested the work being done at that time by Sa uel Berman, then electrical engineer of subway, in the development of an electr magnetic means of locating metallic fra ments buried in human flesh.



The Berman locator

This development had been encourag by Dr. John J. Morehead, the medi director of the subway system, who h suggested to Mr. Berman that such device would be useful in industrial h pitals. The first demonstration of t device was on one of the policemen injur in the New York World's Fair bomb e plosion who continued to suffer pain af apparent recovery from his injury. T device located a small fragment dee embedded in a tendon. Late in 1941 D Morehead, on duty as an officer in t Medical Corps of the United States Arm was called to Hawaii to deliver a series lectures in traumatic surgery. He h with him the first model of the locat which had its second practical demonstr tion immediately following the Pearl Ha bor disaster where its effective use attract wide attention. Following further refi ments in the device, Mr. Berman join the Waugh Equipment Company in D cember, 1942, and a plant has been equipp for the manufacture of the device, on o ders from the federal government, and fro a number of patriotic organizations f presentation to the armed services.

C. A. Gill Elected to Board o American Standards Assn.

CHARLES A. GILL, vice-president charge of operation and maintenance of Reading, has been elected a member of board of directors of the American Stan ards Association—a federation of natio groups dealing with standardization— serve a three-year term effective Janu 1, 1943.

Sleeping and Kitchen Cars for Troop Transportation

THE 1,200 troop sleeping cars and kitchen cars, recently approved by the A sociation of American Railroads and t War department and endorsed by t Office of Defense Transportation, will constructed and owned by the Defe Plant Corporation and will be operated the Pullman Company's fleet of cars u in the transportation of troops. The 1,2 sleeping cars will replace day coaches u used in the transportation of armed forc and the 400 kitchen cars will release ba gage cars now used as mess cars by

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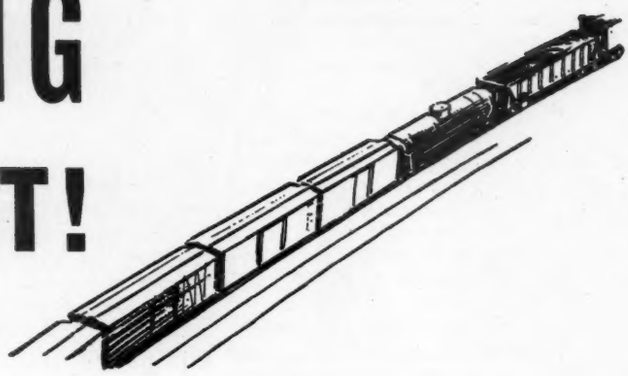
FUEL SAVING
AN ARCH HABIT!



Over 32 years ago railroad men satisfied themselves as to the fuel saving of the locomotive Arch.

Since then the increase in locomotive power, higher rates of combustion and the widespread use of stokers has increased the fuel savings attributable to the Arch.

Today, when conservation of fuel is so vitally important to our war effort, don't handicap the effectiveness of the Arch by skimping on Arch brick. When your locomotives leave the roundhouse, be sure they are equipped with a *complete* Arch.

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists

AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.
Locomotive Combustion Specialists

Army. At present each Army unit sets up its own mess equipment in baggage cars and prepares the food for its men. Under the proposed arrangement, each of the 400 cars will have Army personnel assigned to it permanently.

The new sleeping cars will depart slightly from standard sleeping car construction but will be interchangeable on all railroads and operable in passenger trains. They will have standard passenger-car trucks, underframes, couplers and brakes and standard passenger-car clearances. The width will be 9 ft. and the length 50½ ft. They will contain 30 beds arranged crosswise of the car in tiers of three and capable of accommodating one person each. The construction will be such that the lower and second berths can be lowered into position to serve as the seat and the back of daytime accommodations. The sides of the cars will be insulated and the cars will be equipped with windows, heat, light and toilet facilities. Whether air-conditioning equipment will be installed has not been decided.

The structure of the kitchen cars will be similar to that of the sleeping cars. Although no sleeping accommodations will be incorporated in the kitchen cars, they will be equipped with showers. These cars will also be fitted with iceboxes, cupboards and ranges. It is expected that the 1,600 cars will be completed at the rate of 15 a day, beginning July 1, by builders to be selected by the Defense Plant Corporation, a subsidiary of the Reconstruction Finance Corporation, when it and the War Production Board have approved the plan.

Equipment Depreciation Orders

EQUIPMENT depreciation rates for the Illinois Central, Grand Trunk Western, and the Colorado & Southeastern have been prescribed by the Interstate Commerce Commission in new sub-orders and modifications of previous sub-orders in the general proceeding involving depreciation rates for equipment of steam railroad companies.

Rates for the I. C. are: Steam locomotives, 3.18 per cent; Diesel passenger locomotives, 6 per cent; Diesel switching locomotives, 3.92 per cent; freight-train cars, 4.1 per cent; articulated streamline passenger-train cars, 6.97 per cent; non-articulated streamline passenger-train cars, 3.84 per cent; Diesel rail motor cars, 15.76 per cent; all other passenger-train cars, 2.97 per cent; floating equipment, 3.26 per cent; work equipment, 3.26 per cent; miscellaneous equipment, 14.49 per cent. For the Grand Trunk Western, the following rates are prescribed: Steam locomotives—owned, 3.27 per cent, leased, 2.7 per cent; other locomotives—owned, 3.9 per cent, leased, 3.92 per cent; freight-train cars—owned, 3.3 per cent, leased, 3.1 per cent; passenger-train cars—owned, 4.46 per cent, leased, 2.83 per cent; work equipment, 3.67 per cent; miscellaneous equipment, 9.73 per cent.

Supply Trade Notes

BALDWIN LOCOMOTIVE WORKS.—*Charles E. Brinley*, president of the Baldwin Locomotive Works, has been elected to the newly created position of chairman of the board, and *Ralph Kelly*, executive vice-president, has been elected president. Mr. Brinley will remain chief executive officer and will continue general supervision and direction of the affairs of the company and Mr. Kelly will retain his responsibilities as principal operating officer and will be in charge of the active management of the company's various divisions and wholly-owned subsidiaries. *William H. Harman* has been reelected vice-president in charge of sales. *Frank K. Metzger* of the Standard Steel Works division; *Norris H. Schwenk* of the Cramp Brass and Iron Foundries division; and *Frederick G. Schrans* of the Baldwin Southwark division have been reelected divisional vice-presidents. *Lewis W. Metzger* has been elected divisional vice-president of the Locomotive and Ordnance division to succeed Haldwell S. Colby, resigned, and *W. Horace Holcomb*, formerly assistant to the executive vice-president, has been appointed assistant to the president.

Ralph Kelly

C. E. Brinley

Charles E. Brinley was elected to the presidency of the Baldwin Locomotive Works in December, 1938. Earlier in that year, when the company was reorganized under the Federal Bankruptcy Act, he had been elected a director and member of the executive committee. For a short period following the resignation of G. H. Houston, when the presidency of the company was vacant, he served as acting vice-president with full executive powers. Mr. Brinley was born in Philadelphia on February 25, 1878, and received his higher education in mechanical engineering at Yale University, obtaining his bachelor's degree in 1900 and a degree from the Sheffield Scientific School in 1901. Since 1901 and prior to his association with Baldwin he had been with the American Pulley Company of Philadelphia, Pa. He became president of that company, a concern founded by his father, in 1919. Mr. Brinley is a member of the American Society of Mechanical Engineers, a director of a number of industrial, public utility and insurance companies and a trustee of the Drexel Institute of Technology.

Ralph Kelly was graduated from Harvard University in 1909 and, in the same year, became associated with the Westinghouse Electric & Manufacturing Company as an apprentice in its power engineering department. He served as a lieutenant in the United States Navy during the first World War and in 1920 rejoined the company's engineering department of Westinghouse, subsequently becoming the engineering manager of the company's southwestern district, with headquarters at St. Louis, Mo. He was appointed manager of that

Lewis W. Metzger

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THE SUPERHEATER COMPANY

SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

Representative of
AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
122 S. Michigan Blvd., CHICAGO
• • •
Montreal, Canada
THE SUPERHEATER COMPANY, LTD.

district and later manager of the central district at Pittsburgh, Pa. In 1934 Mr. Kelly was named vice-president in charge of the operating division of Westinghouse and, in 1938, became vice-president in charge of sales. He left Westinghouse in March, 1942, to become executive vice-president and a director of the Baldwin Locomotive Works.

◆

GENERAL STEEL CASTINGS CORPORATION.—*Charles P. Whitehead,* vice-president of sales of the General Steel Castings Corporation, with headquarters at Eddystone, Pa., has had his jurisdiction extended over the manufacturing and engineering departments. *P. R. Keller,* has been appointed manager of miscellaneous sales with headquarters at Eddystone.

◆

MAGNUS CHEMICAL COMPANY, INC.—*J. D. Holmes* has been appointed manager of the newly organized Feedwater Treating division of the Magnus Chemical Company, Inc., Garwood, N. J.

◆

GLOBE STEEL TUBES COMPANY.—*C. J. Bickler,* sales manager of the Cleveland, Ohio, district of the Globe Steel Tubes Company, Milwaukee, Wis., has been appointed assistant to the vice-president in charge of sales, with headquarters at Milwaukee.

◆

AMERICAN STEEL & WIRE COMPANY.—*H. F. Clarke,* assistant superintendent, has been appointed director of spring mill products of the American Steel & Wire Co., a subsidiary of the United States Steel Corporation, to succeed *Leonard C. Peskin,* who has resigned.

◆

H. K. PORTER COMPANY, INC.—*Roy B. Rose,* an executive of the H. K. Porter Company, Inc., Pittsburgh, Pa., has been appointed manager of a new district office for eastern Pennsylvania, western New Jersey, Maryland and Delaware, opened in the Girard Trust Building, Philadelphia, Pa. The Porter Company has been authorized by the Defense Plant Corporation to provide equipment for a plant in Pennsylvania at an approximate cost of $100,000. The new facilities will be operated by the Porter Company, with title remaining with the DPC.

◆

GREENE, TWEED & CO.—*J. J. McIntosh* has been appointed southeastern sales representative and *B. F. Coombs,* Texas sales representative of Greene, Tweed & Co., New York. The headquarters of Mr. McIntosh are at 1106 McLynn avenue, Atlanta, Ga. Mr. Coombs address is Route 12, Box 495, Houston, Tex.

◆

CRANE COMPANY.—*Harry F. Potter,* who has been associated with the Crane Company for 43 years in the finance, credit, operating and sales departments and has been manager of branch houses since 1931, has been elected secretary of the company. *James A. Dwyer,* district manager with headquarters at New York, will succeed Mr. Potter as manager of branch houses. *David J. Molloy,* assistant manager of the New York branch, will succeed Mr. Dwyer as district manager, and *George P. Gregory, Jr.,* has been appointed assistant manager.

◆

SKF INDUSTRIES, INC.—*Thomas W. Dinlocker* has been elected vice-president and treasurer; *Richard H. Demott,* vice-president in charge of sales, and *C. P. Collins,* secretary of SKF Industries, Inc., Philadelphia, Pa.

◆

LIMA LOCOMOTIVE WORKS, INC.—*D. S. Ellis,* until May 1 chief mechanical officer of the Chesapeake & Ohio, the New York, Chicago & St. Louis and the Pere Marquette, has become vice-president in charge of manufacture of the Lima Locomotive Works, Inc., with headquarters at Lima, Ohio. Mr. Ellis was born at Warwick, N. Y., on January 25, 1897, and attended the Warwick High School. In 1916 he became a clerk in the auditor's office of the Lehigh & Hudson River and in 1917 a clerk in the office of the auditor of freight accounts in the New York Central. During a period from 1917 to 1918 he served as a machinist and as acting enginehouse foreman. In 1918 he became a draftsman, serving in this position and as an engineer,

D. S. Ellis

calculator, designer and traveling engineer until 1924. In that year Mr. Ellis was appointed assistant engineer of motive power, New York Central Lines. On May 1, 1929, he left the employ of the New York Central and accepted the position of eastern district manager and, subsequently, manager of the Railroad Division of the Worthington Pump & Machinery Corporation. On October 1, 1932, he resigned to become engineer of motive power on the Advisory Mechanical Committee of the Chesapeake & Ohio; Erie; New York, Chicago & St. Louis, and Pere Marquette with headquarters at Cleveland, Ohio. In January, 1936, Mr. Ellis was appointed mechanical assistant to the vice-president of the C. & O.; N. Y. C. & St. L., and P. M., and in July, 1936, chief mechanical officer.

◆

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—*Thomas T. Bakke,* formerly with the Westinghouse engineering and service department in Milwaukee, Wis., has been appointed manager of the Milwaukee branch of the company's manufacturing and repair division.

◆

PATTERSON-SARGENT COMPANY.—*Ben G. Bowman,* a railway salesman of the Patterson-Sargent Company, Cleveland, Ohio, has been appointed manager of railway sales, in charge of all divisions except New York and Boston. Previous to entering the employ of the Patterson-Sargent Company, Mr. Bowman was employed in various departments of the New York, Chicago & St. Louis and as a freight representative of the Northern Pacific in Cleveland.

◆

INDEPENDENT PNEUMATIC TOOL COMPANY.—*Neil C. Hurley, Jr.,* for the past four years vice-president and director of the Independent Pneumatic Tool Company, Chicago, has been elected executive vice-president. *John A. McGuire,* formerly manager of the accessories department, has been elected secretary, and *E. R. Wyler,* formerly manager of the New York sales office, has been appointed vice-president. Mr. Wyler and Mr. McGuire will have their headquarters in the company's New York offices.

◆

DETROIT LUBRICATOR COMPANY.—*E. J. Doucet,* sales assistant to the president of the Detroit Lubricator Company, has been appointed general sales manager. Mr. Doucet has been associated with the company for the past 26 years. Until two years ago he was in charge of oil-burner equipment sales for the western territory, with headquarters at the company's Chicago office. He was subsequently transferred to the main office at Detroit, Mich., as sales manager in the oil-burner equipment division, and then appointed sales assistant to the president.

◆

COPPERWELD STEEL COMPANY.—*Harry J. Billica,* formerly senior industrial specialist in the War Production Board's office of war utilities, has joined the sales organization of the Copperweld Steel Company. Before his association with the WPB, Mr. Billica was sales engineer for the Indiana Steel & Wire Co., and prior thereto he was associated with the Graybar Electric Company as Pacific district line material manager. *M. A. Williams* has been appointed district sales manager in charge of the new Indianapolis, Ind., sales office. Mr. Williams' territory will include central and southern Indiana, southwestern Ohio and the state of Kentucky.

Army-Navy E Awards

American Car and Foundry Company shipyard. Second renewal.

Johns-Manville, Manville, N. J. March 24.

National Machinery Company, Tiffin, Ohio. March 18.

Pittsburgh Steel Company, Allenport, Pa., and Monessen. March 18.

Whiting Corporation, Harvey, Ill. April 20.

NATIONAL TUBE COMPANY; TUBULAR ALLOY STEEL CORPORATION.—*Charles R. Cox*, executive vice-president of the National Tube Company, has been elected president of this company and the Tubular Alloy Steel Corporation, two subsidiaries of the United States Steel Corporation, to succeed *Benjamin F. Harris*, who has resigned and is now a consultant to the president of the corporation in connection with war activities.

◆

KERITE INSULATED WIRE & CABLE COMPANY.—*C. R. R. Harris* has been elected president of the Kerite Insulated Wire & Cable Company to succeed *Richard D. Brixey*, deceased. Mr. Harris is a native of Randolph county, Indiana. After completing high school and a two-year electrical course, he entered the employ of the Western Electric Company in 1905. In 1910 he joined the engineering staff of the Western Union Telegraph Company where he was engaged for about seven years in plant engineering. In 1917 he joined the Kerite Insulated Wire & Cable Co. in

C. R. R. Harris

charge of engineering. From that date until 1927, when he became vice-president and general manager of the corporation, he was associated with the design and development of Kerite cable for use in many special services in the electric power field. Mr. Harris has been a member of the American Institute of Electrical Engineers for 38 years.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION.—*Dr. Edgar C. Bain*, since 1938 assistant to the vice-president in charge of research and technology for the United States Steel Corporation of Delaware, has been appointed vice-president in charge of research and technology, for the Carnegie-Illinois Steel Corporation, United States Steel subsidiary.

◆

FAIRBANKS-MORSE & CO.—*Charles H. Morse, Jr., Charles H. Morse, III*, and *Robert H. Morse, Jr.*, have been elected directors of Fairbanks-Morse & Co., Chicago. In addition, Robert H. Morse, Jr., assistant sales manager, has been promoted to general sales manager, with headquarters as before at Chicago.

Robert H. Morse, Jr., general sales manager, entered Fairbanks-Morse service in 1916. He enlisted in the U. S. Army in 1917, saw considerable service in France and after the conclusion of the First World War, returned to Fairbanks-Morse, where

Robert H. Morse, Jr.

he spent 10 years in the manufacturing divisions of the company. He then served successively as manager of the branch sales offices at Cincinnati, Ohio, Dallas, Tex., and Boston, Mass., and as manager of sales for the Stoker division. In August, 1942, he was appointed assistant sales manager at Chicago.

◆

ALLEGHENY LUDLUM STEEL CORPORATION.—The Allegheny Ludlum Steel Corporation, Brackenridge, Pa., has transferred its tool steel sales headquarters from Pittsburgh, Pa., to Dunkirk, N. Y., in order to centralize both sales and manufacturing supervision of tool steels at Dunkirk.

Obituary

CHARLES WILLIAM WERST, chief inspector of the Baldwin Locomotive Works, died at the age of 75 years, in West Palm Beach, Fla. Mr. Werst entered the employ of the Baldwin Locomotive Works in 1898. He served as foreman and superintendent of a number of shops until 1910, when he left to become general superintendent of the Lima Locomotive Works, returning to Baldwin in 1915. In World War I he headed a group of engineers and mechanics who went to Russia to assemble Baldwin locomotives.

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RICHARD DEWOLFE BRIXEY, president and treasurer of the Kerite Insulated Wire & Cable Co., Inc., New York, died on March 14. He was 63 years of age. Mr. Brixey was born in Seymour, Conn., in 1880. Following his graduation from the Sheffield Scientific School at Yale University in 1902, he immediately began work in the Seymour plant of the company, which was owned by his father, W. R. Brixey. He worked his way through all the processes of manufacturing and was particularly interested in the later developments of Kerite for railroad signal service, a pioneer operation of the Seymour plant. He came to the New York office of the company as general manager in 1910 and reorganized the business in 1912 under its present corporate name, the Kerite Insulated Wire & Cable Co., Inc., of which he became president and treasurer. Mr. Brixey was a member of the signal section and the telephone and telegraph section of the Association of American Railroads; a member of the Association of Railway

Richard DeWolfe Brixey

Electrical Engineers; the Railway Business Association; the American Institute of Electrical Engineers; the American Society for Testing Materials; the rubber division of the American Chemical Society; the National Electrical Manufacturers Association; and the Railroad-Machinery Club.

◆

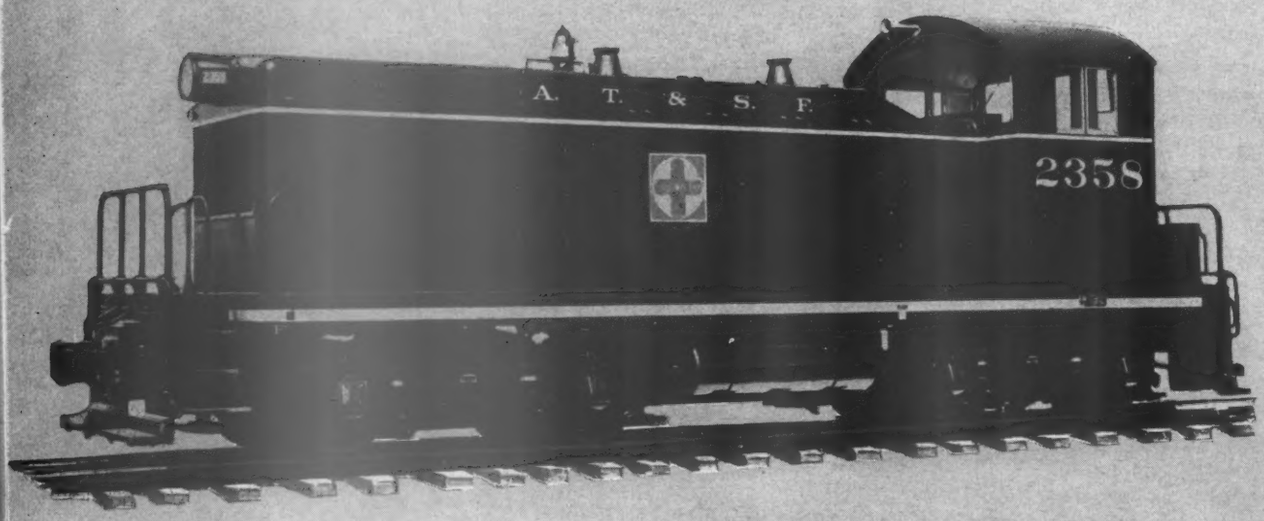
JOHN W. FOGG, vice-president and general manager of sales of the MacLean-Fogg Lock Nut Company, Chicago, died on March 5. Mr. Fogg was born in England and at an early age moved to Canada where he received his education. He entered the service of the Grand Trunk Western and served his apprenticeship at

J. W. Fogg

Hamilton, Ont. Later he came to the United States and worked as a locomotive engineer on the Wisconsin Central and then on the Chicago Terminal. When the Terminal was taken over by the Baltimore & Ohio, he became traveling engineer and later master mechanic of the Baltimore & Ohio Chicago Terminal. He resigned to become a sales representative of the Boss Nut Company, of which he became manager of the sales department and then

(*Continued on second right-hand page*)

The BALANCE



General Motors Diesel Switchers are speeding up terminal and yard operations with maximum protection to cars and lading.

General Motors Diesel Road Locomotives in passenger and freight service are playing a vital role in the movement of our fighting forces and materiels.

Santa Fe

GENERAL MOTORS
LOCOMOTIVES

general manager. Later he was appointed vice-president of the American Bolt Corporation. In 1925, he and the late John A. MacLean, Sr., founded the MacLean-Fogg Lock Nut Company, of which Mr. Fogg has served as vice-president and general manager of sales since its organization. Throughout his career, Mr. Fogg had been active in the work of railway supply associations. For the last 25 years he was treasurer of the Western Railway Club and in 1937 was its executive secretary. For a number of years he was a director of the Car Department Officers' Association and at the time of his death was president of the Allied Railway Supply Association, Inc., and a member of the board of the Railway Supply Manufacturers Association.

◆

A. REAMY JOYCE, district sales manager of the Wood Preserving division of the Koppers Company, at Marietta, Ohio, died suddenly in that city on April 7.

Personal Mention

General

H. C. VINSANT, shop superintendent of the Texas & Pacific, has been appointed assistant mechanical superintendent, with headquarters as before at Dallas, Tex.

F. R. DENNEY, assistant mechanical superintendent of the Texas & Pacific at Dallas, Tex., has been appointed mechanical engineer, with headquarters at Dallas.

F. J. HERTER, mechanical assistant, office of chief mechanical officer—cars, of the Pere Marquette at Cleveland, Ohio, has been promoted to the position of mechanical engineer, with headquarters at Grand Rapids, Mich.

EDWIN J. KUECK, who has been appointed assistant superintendent of motive power of the St. Louis Southwestern, with headquarters at Pine Bluff, Ark., as announced in the April issue, was born at Sedalia, Mo., on June 26, 1892, and is a graduate of the Washington University (St. Louis, Mo.). He entered railroad service on September 6, 1907, as a messenger in the employ of the Missouri Pacific, and in 1909 became a machinist of the Atchison, Topeka & Santa Fe at Argentine, Kan. In 1914 Mr. Kueck returned to the Missouri Pacific as a draftsman at St. Louis, Mo., and three years later became a draftsman of the St. Louis Southwestern at Pine Bluff. He subsequently served as chief draftsman and acting mechanical engineer at Pine Bluff, becoming assistant superintendent of motive power on February 1, 1943.

Edwin J. Kueck

W. G. REID, assistant superintendent of motive power of the Southern Pacific at El Paso, Tex., has been appointed superintendent of motive power, with headquarters at El Paso. Mr. Reid was born at Cedar Rapids, Iowa, and entered the employ of the Southern Pacific in 1903 as a machinist apprentice at Tucson, Ariz. In 1907 he became a machinist in the employ of the Southern Pacific of Mexico at Guaymas, Son. From 1908 to 1913 he served as a machinist on the Arizona Eastern at Globe, Ariz., and in the latter year was promoted to the position of foreman and later to general foreman. In 1918 he became trainmaster at Globe and a short time later master mechanic at Phoenix. In 1924 he was transferred to El Paso. In July, 1941, Mr. Reid was appointed assistant superintendent of motive power at El Paso.

W. G. Reid

R. U. LIPSCOMB, superintendent of motive power of the Southern Pacific at El Paso, Tex., has retired.

A. C. HOWARD, assistant mechanical engineer of the Pere Marquette, with headquarters at Detroit, Mich., has been transferred to the staff of the chief mechanical officer, at Cleveland, Ohio.

CARL E. JOHANSSON, chief car draftsman, Advisory Mechanical Committee, of the Pere Marquette, has been appointed mechanical assistant—cars, office of chief mechanical officer, at Cleveland, Ohio.

RALPH D. BRYAN, engineer of car construction of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed to the newly created position of mechanical assistant at Chicago.

MINOTT BROOKE has been appointed fuel service agent of the Chesapeake & Ohio, with headquarters at Huntington, W. Va., succeeding G. G. Ritchie, who has been granted leave of absence to enter the armed forces.

CLARENCE JEPSEN, Diesel maintainer of the Chicago, Burlington & Quincy, has been appointed mechanical inspector in charge of passenger motor cars and Diesel equipment of the Eastern district, with headquarters as before at Chicago.

D. R. CALLERI, master mechanic of the Rio Grande division of the Southern Pacific at El Paso, Tex., has been appointed assistant superintendent of motive power, with headquarters at El Paso.

Master Mechanics and Road Foremen

A. H. JOHNSTONE, assistant master mechanic of the Southern Pacific at West Oakland, Calif., has been appointed master mechanic of the Rio Grande division, with headquarters at El Paso, Tex.

DAVID BEATH, division master mechanic of the Canadian Pacific at Moose Jaw, Sask., has been transferred to the position of division master mechanic at Calgary, Alta.

H. E. LOGAN, road foreman of the Chicago, Burlington & Quincy at St. Joseph, Mo., has been appointed to the newly created position of assistant master mechanic of the St. Joseph division, with headquarters at Kansas City, Mo.

J. M. VANCE has been appointed master mechanic of the Kentucky & Indiana Terminal, with headquarters at Louisville, Ky., succeeding R. P. O'Neil, who has resigned.

F. D. KENNEDY, master mechanic of the Erie at Avoca, Pa., has been transferred to the position of master mechanic at Marion, Ohio, succeeding C. J. Gerbes, who has been granted a leave of absence.

H. I. PHELPS, general foreman of the Erie at Jersey City, N. J., has been appointed master mechanic, with headquarters at Avoca, Pa.

R. W. WILSON, general foreman of the Canadian Pacific, has been promoted to the position of division master mechanic, with headquarters as before at Moose Jaw, Sask.

(*Turn to second left-hand page*)

APRIL 10th

★ WAS M-7 DAY ★ ★ ★

Schenectady celebrated the completion, one year ago, of the "tank killer" that helped turn the tide at El Alamein.

It was built without a blueprint. It was asked for in three months—and completed in less than three weeks. It was a military secret exposed to constant public view — yet when it appeared at El Alamein it was a complete surprise to the enemy.

Rommel had never seen anything like it before —and probably never wants to see anything like it again. For this strange hybrid monster—a combination of 105 mm. howitzer and M-3 tank—expertly handled by the men of the British Eighth Army, left 500 Nazi tanks in wreckage and flames and helped start the so-called "Desert Fox" on his way back to Berlin.

One year ago it rolled off the assembly lines in Schenectady. It was then called, technically, the M-7. In its baptism of fire, it was given the much more descriptive name of "tank killer".

The men and women who were in on its birth had a rough idea of its importance. But they never realized that this deadly product of their skill and effort would play so vital a part in one of the most decisive battles of history—a battle, the successful outcome of which enables us of the United Nations to speak with hope today of the post-war world. Before El Alamein, no one dared think in those terms.

On April 10th we celebrated the appearance of the first M-7, in humble gratitude that we in Schenectady could contribute to a decisive victory thousands of miles away and so heighten the hopes of freedom-loving people everywhere.

To the following goes full credit for the amazing job the M-7 has done . . .

1 To its designers and engineers for their Yankee courage and ingenuity in building the M-7 in record time.

2 To the 10,000 men and women at the Schenectady plant who pitched in to turn the M-7 out in sufficient numbers to turn Rommel.

3 To the populace of Schenectady—who saw the M-7s rumbling through the streets—and kept their lips discreetly buttoned.

4 To the American railroads for the splendid job they did of getting every M-7 to its point of embarkation.

5 To the United States Navy for transporting these tank killers across thousands of miles of water and delivering them safely.

6 To the heroic men of the British Eighth Army whose expert use of the M 7 finally blasted Rommel's hopes of getting through to Suez.

7 And to the hundreds of sub-contractors and suppliers, and others, for their unflagging cooperation in the building of this mighty weapon of war.

★

AMERICAN LOCOMOTIVE

MANUFACTURERS OF MOBILE POWER

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, MARINE DIESELS, TANKS, GUN CARRIAGES & OTHER ORDNANCE

L. E. Quirin, general foreman of the Chicago, Burlington & Quincy at West Burlington, Iowa, has been appointed to the newly created position of master mechanic of the Chicago Terminal, with headquarters at Chicago.

C. I. Clugh, who has been appointed master mechanic of the Philadelphia Terminal division of the Pennsylvania, with headquarters at Philadelphia, Pa., as announced in the March issue, was born on May 14, 1901, at Altoona, Pa. In 1926 he received the degree of B.S.M.E. at Purdue University. He began his railroad career on June 4, 1918, as a machinist apprentice in the employ of the Pennsylvania. He became a machinist on June 22, 1922; a special apprentice on July 10, 1923; motive power inspector on September 18, 1926; gang foreman on March 15, 1930;

C. I. Clugh

enginehouse foreman on December 1, 1936; assistant master mechanic on May 1, 1937; enginehouse foreman on June 16, 1938; resident material inspector on March 15, 1939; acting chief material inspector on February 15, 1941, and master mechanic at Philadelphia on February 1, 1943.

Frank Revana, general foreman of the Erie at Cleveland, Ohio, has been appointed master mechanic of the Mahoning Division, with jurisdiction over Cleveland, Brier Hill, Niles, Leavittsburgh, Akron, and Ferrona, Pa.

C. R. Johnson, who has been on furlough from the Central of Georgia since December 16, 1942, has resumed his duties as road foreman of engines of the Macon division of that road. Mr. Johnson's headquarters are at Macon, Ga.

Car Department

M. Russell Buck, assistant to the engineer of car construction of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed engineer of car construction at Topeka.

C. F. Weaver, who has been appointed assistant general superintendent of car equipment of the Canadian National with headquarters at Toronto, Ont., as announced in the March issue, was born at London, England. He entered railway service in 1919 as a carpenter in the Montreal (Que.) car shop of the Canadian National, and subsequently served successively as assistant foreman and as superintendent of car shop until October 1, 1928,

C. F. Weaver

when he became superintendent of car equipment of the Montreal district. In 1937, Mr. Weaver was appointed superintendent of car shop at London, Ont., the position he was holding prior to his appointment as assistant general superintendent of car equipment.

Shop and Enginehouse

A. Hopkins, machine inspector of the Chesapeake & Ohio at Hinton, W. Va., has been promoted to the position of assistant enginehouse foreman at Hinton.

C. A. Kothe, general foreman of the Erie at Meadville, Pa., has been appointed shop superintendent, Meadville production shop.

C. M. Stubbs, enginehouse foreman of the Erie at Jersey City, N. J., has been promoted to the position of general foreman, with headquarters at Buffalo, N. Y.

F. C. Johnson, division master mechanic of the Canadian Pacific at Calgary, Alta., has been appointed locomotive foreman at Sutherland, Sask.

Purchasing and Stores

T. F. Murphy has been appointed purchasing agent and storekeeper of the Spokane International, with headquarters at Spokane, Wash.

H. A. Paar, division storekeeper of the Michigan Central at Jackson, Mich., has been appointed assistant general storekeeper of the New York Central at Beech Grove, Ind.

H. O. Wolfe, assistant to the purchasing agent, of the Baltimore & Ohio has been appointed purchasing agent of the Alton, with headquarters as before at Chicago, succeeding W. S. Galloway, who continues as purchasing agent of the B. & O., at Baltimore, Md.

Trade Publications

Copies of trade pulications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

"Oxyacetylene Flame Adjustments."—Air Reduction, 60 East Forty-second street, New York. Natural color photographs to guide the student in adjusting the oxyacetylene flame.

◆

Brazing Alloys.—Handy & Harman, 82 Fulton street, New York. Revised eighteen-page illustrated Bulletin No. 12-A descriptive of low temperature brazing of metals with Sil-Fos and Easy-Flow alloys.

◆

Hicycle Portable Electric Tools.—Chicago Pneumatic Tool Company, 6 East Forty-fourth street, New York. Catalog No. 900. Section 1—Drills and reamers; Section 2—Screw drivers, nut runners, stud setters, tappers; Section 3—Radial arms; Section 4—Grinders, sanders, buffers, polishers.

◆

Contour Saws.—Doall Service Company, 1201 Thacker street, Des Plaines, Ill. Illustrated text book of 265 pages on latest techniques for contour machining: internal and external three-dimensional parts for short-run forgings, multiple identical parts in one operation for short run stampings, and facilities for handling both massive or small jobs.

◆

Foamite Fire-Fighting Car.—American LaFrance Foamite Corporation, Elmira, N. Y. Four-page bulletin descriptive of Foamite Fire-Fighting Car for use in fighting fires on right-of-way, especially those common in derailments of cars hauling flammable liquids. Center pages show layout of fire-fighting equipment for adaptation to any freight car approximately 50 ft. in length.

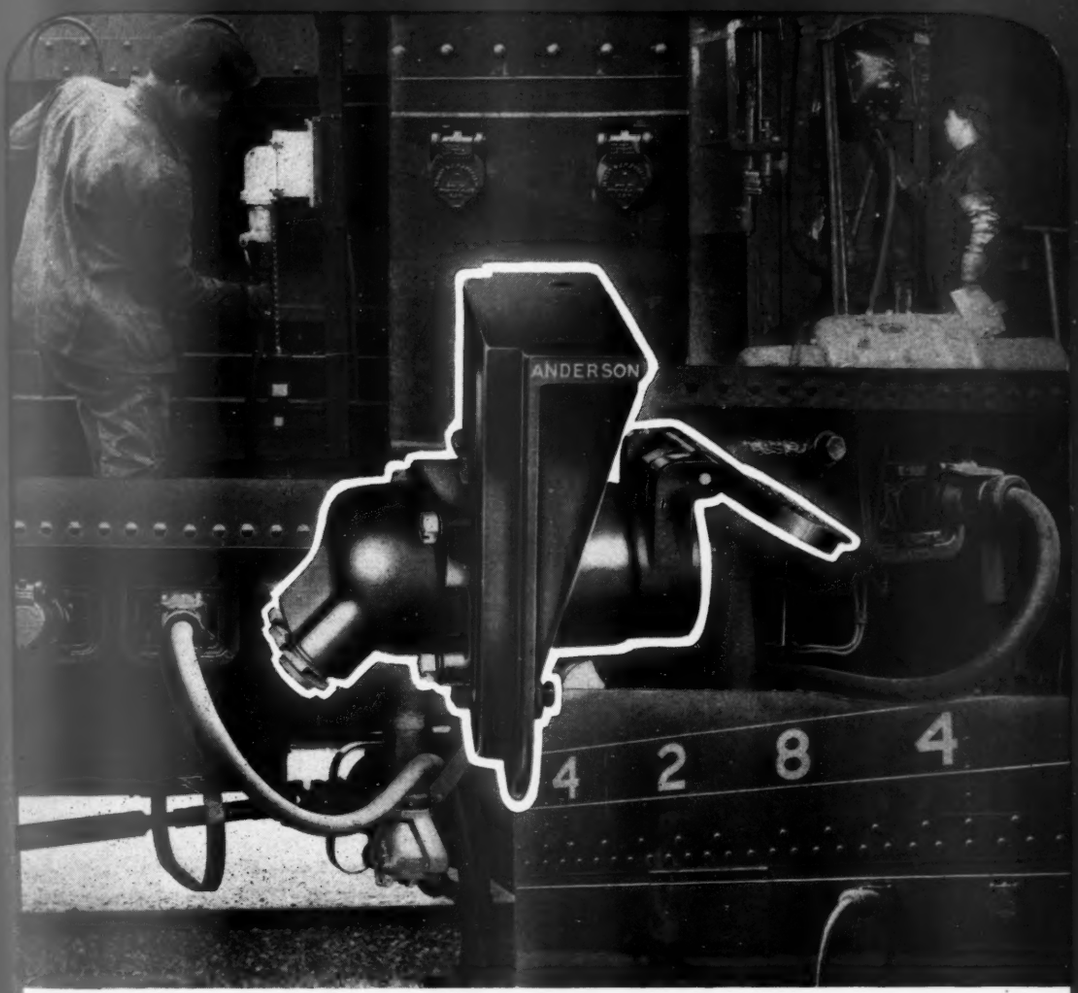
◆

Strain Gage.—Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia, Pa. Twenty-four page Bulletin No. 171 on SR-4 strain gage. Gage consists of one, or a properly oriented group of two or three, fine wires cemented to the surface subject to stress change. These are connected, in the simplest arrangement of parts, to a portable Wheatstone bridge unit, the unbalance of which becomes a measure of stress change.

◆

Optical Comparators.—Jones & Lamson Machine Co., Springfield, Vt. Twenty-page spiral-bound booklet entitled "Beyond a Shadow of a Doubt." Presents advantages and possibilities of inspection of production parts and measurement of tools and gages by comparison, by optical projection, of a part with a master template or outline. Illustrates many tools and parts, inspection of which is being done with the comparators, also a number of steps in the building of the comparators.

ANDERSON'S ADVANTAGES ARE MANY



ALL Anderson products are made of high grade material by expert workmen to strict specifications, hence they will serve your railroad faithfully over a long period of time.

In these times of stress such features are dominant factors in preventing delays in shop work in the yards and on the road. It pays to specify Anderson Plugs and Receptacles.

ARMY E NAVY

ANDERSON

ALBERT J. ANDERSON MFG. CO.

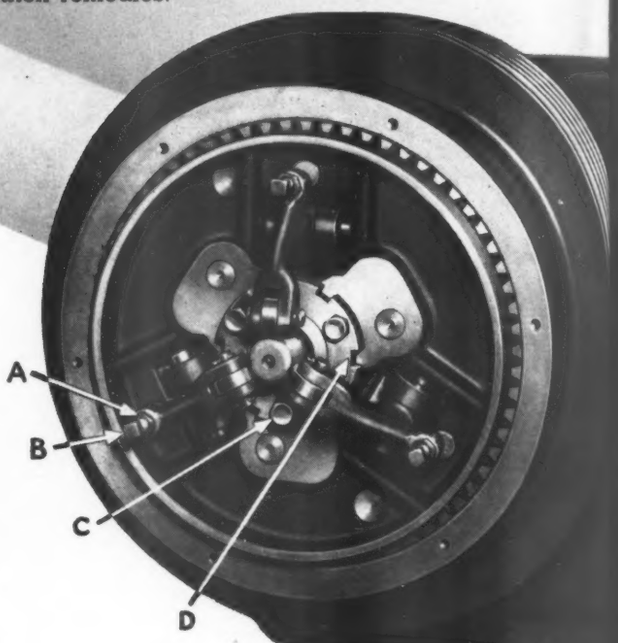
289-305 A Street, Boston, Mass.

NEW YORK CHICAGO PHILADELPHIA LONDON

I'm Tellin' You

No. 10 in a Series of Tips on "Keeping 'em Turning"
by Tom Toker, 40 years at LeBlond

Any lathe requires adjustment from time to time. H
often depends on the type of operation and sometimes
the operator. Although it is seldom needed, the clutch
one spot to watch. If I tried to explain the "whys and whe
fores" of the mechanics involved in the LeBlond clutch
would take several of these pages, which the "front of
boys" assure me can't be bought with marbles. So with
going into details, here are two symptoms of trouble a
their remedies:



Loss of power — When the lathe slows under cut and the flow of power is irregular or jumpy, it's a pretty fair sign that the clutch is slipping.

Here's the remedy:

1. Put clutch in engaged position.
2. Drain oil through plug at bottom of clutch cover.
3. Remove the six screws to take off cover.
4. Loosen three lock nuts on clutch fingers (A).
5. Turn three screws equal degrees to the right (B).
6. Tighten three screws (B) until belt slips when spindle is blocked. With even adjustment, push rod will run dead center.
7. Tighten lock nuts (A).
8. Replace cover, refill with oil.

Hot clutch box — When there is too little clearance between the clutch plates while the lathe idles, friction overheats the non-circulating oil, breaking down its lubricating properties. When this happens, the cover plate will be hot to the touch.

Here's what to do:

1. With the oil drained, cover plate removed and clutch engaged, remove three screws (C).
2. Use a spanner wrench to tighten lug nut (D).
3. After checking manual for exact number of turns, back off lug nut. Check with feeler gauge the space specified between clutch hub and adjusting nut.
4. Replace screws (C) to draw clutch assembly tight against nut in proper operating position.
5. Replace cover plate and refill with oil.

ARMY E NAVY

THE R. K. LeBLOND MACHINE TOOL C
CINCINNATI, OHIO

Largest Manufacturer of a Complete Line of Lath